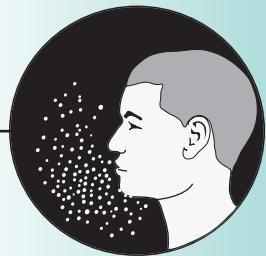


RESPIRATORY HAZARDS



Chapter 296-841 WAC

November 2004 Edition

Washington Industrial Safety & Health Act

Standards Update to

Chapter 296-841 WAC, Respiratory Hazards

**Issue Date 11/2004
Effective Date 11/01/2004**

The department recently adopted changes to chapter 296-841 WAC, Respiratory hazards. The primary reason for this rule making was to correct errors located in the permissible exposure limits table. We also made additional changes to clarify the language, correct the explanation of the mixtures formula, and fixed some formatting errors. **Please replace chapter 296-841 WAC with attached.**

To receive future updates of this standard and all other Department of Labor and Industries safety and health standards electronically, please sign up on the WISHA Listserv (<http://www.lni.wa.gov/Safety/Rules/default.htm>). By subscribing to the Listserv, you will also receive rule updates, hearing notices, and informational packets for all safety and health rules.

Also available on the WISHA web site:

- WISHA Core Rules
- Other General WISHA Rules
- Industry and Task-specific Rules
- Proposed rules and hearings
- Newly adopted rules and new rule information
- WISHA Regional Directives (WRDs)
- WISHA Interim Operations and Interpretive Memoranda (WIIM)
- Memoranda of Understanding (MOU)

To receive hardcopy updates of this rule, please return the card located at the back of the book.

Respiratory Hazards

Chapter 296-841 WAC

Other Rules that may apply to your workplace

- The WISHA Safety and Health Core Rules, Chapter 296-800 WAC, contain the basic requirements that apply to most employers in Washington. They also contain:
 - An Introduction that lists important information you should know, including a section on building, fire and electrical codes.
 - A Resource section that includes a complete list of all WISHA rules and a directory of the Labor and Industries (L&I) offices.
- Other WISHA rules may apply to you, depending on the activities and operations of your workplace. Contact your local L&I office if you're uncertain about which WISHA requirements apply to you.
- To go online to access all the Safety and Health Rules: <http://www.lni.wa.gov/wisha>
- If you would like to receive e-mail notification of rule updates, please register for the Standards Listserv on the WISHA web site at <http://www.lni.wa.gov/home/listservs.htm>
- For a CD or paper copy contact us by:

Mail: Department of Labor and Industries
 P.O. Box 44620
 Olympia, WA 98504-4620

Telephone: 1-800-4BE-SAFE (1-800-423-7233)

1 • 800 • 4BE SAFE

(1 • 800 • 423 • 7233)

Respiratory Hazards

Chapter 296-841 WAC

Quick Reference

WAC Number	Title of Rule	Page
296-841-100	Scope.....	100-1
296-841-200	Evaluate and Control Employee Exposures	200-1
296-841-300	Definitions	300-1
	Resources.....	R-1
	Index.....	IN-1
	Statutory Authority	SA-1

1 • 800 • 4BE SAFE (1 • 800 • 423 • 7233)

Respiratory Hazards

Chapter 296-841 WAC

Contents

296-841-100	Scope.....	100-1
296-841-200	Evaluate and Control Employee Exposure	200-1
296-841-20005	Identify and evaluate respiratory hazards	200-2
296-841-20010	Control employee exposures.....	200-4
296-841-20015	Use respirators	200-6
296-841-20020	Notify employees	200-6
296-841-300	Definitions	300-1
	Resources	R-1
	HELPFUL TOOLS	
	Mixture of Airborne Substances	R-1
	Index.....	IN-1
	Statutory Authority	SA-1

Respiratory Hazards

Chapter 296-841 WAC

Contents

Respiratory Hazards

WAC 296-841-100

Scope

Scope



This chapter applies **only** if your employees:

- Are exposed to a respiratory hazard
or
- Could be exposed to one of the specific hazards listed below.

This chapter applies to any workplace with potential or actual employee exposure to respiratory hazards. It requires you to protect employees from respiratory hazards by applying this protection strategy:

- Evaluate employee exposures to determine if controls are needed
- Use feasible controls. For example, enclose or confine the operation, use ventilation systems, or substitute with less toxic material
- Use respirators if controls aren't feasible or if they can't completely remove the hazard.



Definition:

Exposed or exposure - The contact an employee has with a toxic substance, harmful physical agent or oxygen deficient condition, whether or not protection is provided by respirators or other personal protective equipment (PPE). Exposure can occur through various routes of entry, such as inhalation, ingestion, skin contact, or skin absorption.

-Continued-

Respiratory Hazards

WAC 296-841-100

Scope

WAC 296-841-100 (Continued)



Note:

- Examples of substances that may be respiratory hazards when airborne include:
 - Chemicals listed in Table 3
 - Any substance
 - Listed in the latest edition of the NIOSH Registry of Toxic Effects of Chemical Substances
 - For which positive evidence of an acute or chronic health hazard exists through tests conducted by, or known to, the employer
 - That may pose a hazard to human health as stated on a material safety data sheet kept by, or known to, the employer
 - Atmospheres considered oxygen deficient
 - Biological agents such as harmful bacteria, viruses or fungi
 - Examples include airborne TB aerosols and anthrax
 - Pesticides with a label requirement for respirator use
 - Chemicals used as crowd control agents such as pepper spray
 - Chemicals present at clandestine drug labs.
- These substances can be airborne as dusts, fibers, fogs, fumes, mists, gases, smoke, sprays, vapors, or aerosols.

-Continued-

Respiratory Hazards

WAC 296-841-100

Scope

WAC 296-841-100 (Continued)



Reference:

- Substances in Table 3 that are marked with an X in the "skin" column may require personal protective equipment (PPE). See WAC 296-800-160, Personal protective equipment, for additional information and requirements.
- If any of the following hazards are present in your workplace, you will need both this chapter and any of the following specific rules that apply:

Hazard	Rule that applies
Acrylonitrile	WAC 296-62-07336
Arsenic (inorganic)	WAC 296-62-07347
Asbestos	WAC 296-62-077
Benzene	WAC 296-62-07523
Butadiene	WAC 296-62-07460
Cadmium	WAC 296-62-074 through 296-62-07449 or 296-155-174
Carcinogens	Chapter 296-62 WAC, Part F
Coke ovens	Chapter 296-62 WAC, Part O
Cotton dust	Chapter 296-62 WAC, Part N
1, 2-Dibromo-3-chloropropane	WAC 296-62-07342
Ethylene oxide	WAC 296-62-07355
Formaldehyde	WAC 296-62-07540
Lead	WAC 296-62-07521 or 296-155-176
Methylene chloride	WAC 296-62-07470
Methylenedianiline	WAC 296-62-076 or 296-155-173
Thiram	WAC 296-62-07519
Vinyl chloride	WAC 296-62-07329

Scope



Notes

1 • 800 • 4BE SAFE (1 • 800 • 423 • 7233)

Evaluate and Control Employee Exposures

WAC 296-841-200

Summary

YOUR RESPONSIBILITY:

To protect your employees from exposure to respiratory hazards in the workplace by identifying and controlling the hazards

You must

Identify and evaluate respiratory hazards WAC 296-841-20005	200-2
Control employee exposures WAC 296-841-20010	200-4
Use respirators WAC 296-841-20015	200-6
Notify employees WAC 296-841-20020	200-6
Permissible exposure limits of air contaminants WAC 296-841-20025	200-8

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20005

Identify and evaluate respiratory hazards

You must

- Make sure employees are protected from potentially hazardous exposure while you perform your evaluation
- Perform your evaluation without considering the protection provided to employees by a respirator
- Determine the form of the hazard, such as dust, mist, gas, oxygen deficiency, or biological agent.
- Make sure you consider:
 - Potential emergency and rescue situations that may occur, such as equipment or power failures, uncontrolled chemical reactions, fire, explosion, or human error
 - Workplace conditions such as work processes, types of material, control methods, work practices and environmental conditions.
- Determine or reasonably estimate whether any employee is or could be exposed to any of the following:
 - Any airborne substance above a permissible exposure limit (PEL) listed in Table 3
 - A substance at or above the action level (AL) specified in the rule for that substance
 - Any other respiratory hazard.



-Continued-

Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20005 (Continued)

You must

- Use **any** of the following to determine employee exposure:
 - Information that would allow an estimate of the level of employee exposure, such as MSDSs or pesticide labels, observations, measurements or calculations
 - Data demonstrating that a particular product, material or activity can't result in employee exposure at or above the AL or PEL
 - Personal air samples that represent an employee's usual or worst case exposure for the entire shift.



Note:

- Rules for specific substances may contain additional requirements for determining employee exposure.
- Use methods of sampling and analysis that have been validated by the laboratory performing the analysis.
- Samples from a representative group of employees may be used for other employees performing the same work activities when the duration and level of exposure are similar.

Evaluate and Control
Employee Exposure



You must

- Consider the atmosphere to be immediately dangerous to life or health (IDLH) when you can't determine or reasonably estimate employee exposure
- Make sure employee exposure, to 2 or more substances with additive health effects, is evaluated using this formula:

-Continued-

Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20005 (Continued)

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \dots + \frac{C_n}{L_n}$$

The symbol	Is the
E	Equivalent exposure for the mixture. When the value of E is greater than 1, a respiratory hazard is present.
C	Concentration of a substance.
L	TWA, STEL, or ceiling for that substance, from Table 3.



Helpful Tool:

Mixtures of Airborne Substances

You can find additional information about mixtures of airborne substances in the Resources section of this chapter.

WAC 296-841-20010

Control employee exposures

IMPORTANT:

Using respirators and other PPE isn't a substitute for the feasible controls required by this section.

You must

- Use feasible controls to protect employees from exposure to respiratory hazards by:
 - Reducing employee exposure to a level that removes the respiratory hazard, such as to a level below the permissible exposure limit (PEL) in Table 3

or

- Reducing the exposure to the lowest achievable level, when the respiratory hazard can't be removed.

-Continued-

1 • 800 • 4 BE SAFE (1 • 800 • 423 • 7233)

Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20010 (Continued)



Note:

➤ The following table gives you examples of control methods.

Table 1
Examples of Possible Controls

Control	For example
Using a different chemical (substitution)	<ul style="list-style-type: none">Choose a chemical with a lower evaporation rate or vapor pressureChoose a chemical without hazardous ingredients
Changing a process to lessen emissions	<ul style="list-style-type: none">Use hand rolling or paint dipping instead of paint sprayingBolt items instead of welding them
Separating employees from emissions areas and sources	<ul style="list-style-type: none">Use control roomsBuild an enclosure around process machinery or other emissions sourcesAutomate a process
Removing emissions at or near the source (local exhaust ventilation)	<ul style="list-style-type: none">Install exhaust hoods or slots to capture emissionsUse an exhausted enclosure (like a blasting cabinet or laboratory hood)
Diluting and removing emissions in the work area (general exhaust ventilation)	<ul style="list-style-type: none">Allow natural air movement to create an adequate airflow through an areaUse mechanical fans
Modify work practices	<ul style="list-style-type: none">Change the position of the worker relative to the work so fumes, vapors, or smoke doesn't go into their face
Rotate employees – Some specific rules prohibit the use of this control method	<ul style="list-style-type: none">Move employees to another job that's without exposure, on a schedule to keep their total exposure below the permissible exposure limit



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20015

Use respirators

You must

- Require employees to use respiratory protection when respiratory hazards haven't been removed using feasible controls. For example, use respirators at any of the following times:
 - While controls are being evaluated or put in place
 - When the respiratory hazard isn't completely removed
 - When controls are **not** feasible.



Reference:

- See chapter 296-842 WAC, *Respirators*, for respirator program requirements.

WAC 296-841-20020

Notify employees

You must

- Notify employees who are, or may be, exposed to respiratory hazards, as specified in Table 2.



Note:

- The notification may be provided either individually, to a group, or by posting of results in an appropriate location that is accessible to affected employees.

-Continued-

Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20020 (Continued)

Table 2
Notification Requirements

Notify employees of	As follows
Any exposure result above a permissible exposure limit (PEL)	Within 5 business days, after the employee's exposure result is known to the employer
The corrective action being taken to reduce employee exposure to or below the PEL and The schedule for completion of the corrective action and any reasons why exposures can't be lowered to below the PEL	Within 15 business days, after the employee's exposure result is known to the employer
An exposure to these substances: <ul style="list-style-type: none">• Acrylonitrile• Arsenic (inorganic)• Asbestos• Benzene• Butadiene• Cadmium• Coke oven emissions• Cotton dust• 1,2-Dibromo-3-chloropropane• Ethylene oxide• Formaldehyde• Lead• Methylene chloride• Methylenedianiline• Vinyl chloride	In writing, as specified in the rule specific to the substance

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20025

Permissible exposure limits of air contaminants

IMPORTANT:

The following information applies to Table 3, Permissible Exposure Limits for Air Contaminants.

- Exposure needs to be determined from personal air samples taken in the breathing zone **or** from monitoring representative of the employee's breathing zone.
- Ppm refers to parts of vapor or gas per million parts of air by volume, at 25° C and 760 mm Hg pressure.
- Mg/m³ refers to milligrams of substance per cubic meter of air.
- For a metal that's measured as the metal itself, only the CAS number for the metal is given. The CAS numbers for individual compounds of the metal aren't provided. For more information about CAS registry numbers see the website: <http://www.cas.org>.
- Time weighted averages (TWA₈) represent the maximum allowed average exposure for any 8-hour time period. For work periods longer than 8-hours the TWA₈ needs to be determined using the 8 continuous hours with the highest average concentration.
- Short-term exposure limits (STEL) represent maximum allowed average exposure for any 15-minute period, unless another time period is noted in Table 3.
- The ceiling represents the maximum allowed exposure for the shortest time period that can feasibly be measured.
- An "X" in the "skin" column indicates the substance can be absorbed through the skin, either by airborne or direct contact.
- Requirements for the use of gloves, coveralls, goggles, and other personal protective equipment can be found in WAC 296-800-160.

-Continued-

Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

WAC 296-841-20025 (Continued)

- The respirable fraction of particulate is measured by sampling with a size-selector having the following characteristics:

Mean aerodynamic diameter in micrometers	Percent passing the selector
1	97
2	91
3	74
4	50
5	30
6	17
7	9
8	5
10	1

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Abate (Temephos)	3383-96-8	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Acetaldehyde	75-07-0	100 ppm	150 ppm	----	----
Acetic acid	64-19-7	10 ppm	20 ppm	----	----
Acetic anhydride	108-24-7	----	----	5 ppm	----
Acetone	67-64-1	750 ppm	1,000 ppm	----	----
Acetonitrile	75-05-8	40 ppm	60 ppm	----	----
2-Acetylaminofluorene (see WAC 296-62-073)	53-96-3	----	----	----	----
Acetylene	74-86-2	Simple asphyxiant	----	----	----
Acetylene dichloride (1,2-Dichloroethylene)	540-59-0	200 ppm	250 ppm	----	----
Acetylene tetrabromide	79-27-6	1 ppm	3 ppm	----	----
Acetylsalicylic acid (Aspirin)	50-78-2	5 mg/m ³	10 mg/m ³	----	----
Acrolein	107-02-8	0.1 ppm	0.3 ppm	----	----
Acrylamide	79-06-1	0.03 mg/m ³	0.09 mg/m ³	----	X
Acrylic acid	79-10-7	10 ppm	20 ppm	----	X
Acrylonitrile (Vinyl cyanide) (see WAC 296-62-07336)	107-13-1	2 ppm	10 ppm	----	----
Aldrin	309-00-2	0.25 mg/m ³	0.75 mg/m ³	----	X
Allyl alcohol	107-18-6	2 ppm	4 ppm	----	X
Allyl chloride	107-05-1	1 ppm	2 ppm	----	----
Allyl glycidyl ether (AGE)	106-92-3	5 ppm	10 ppm	----	----
Allyl propyl disulfide	2179-59-1	2 ppm	3 ppm	----	----
alpha-Alumina (Aluminum oxide)	1344-28-1	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----

1 • 8 0 0 • 4 B E S A F E (1 • 8 0 0 • 4 2 3 • 7 2 3 3)



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Aluminum (as Al)	7429-90-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Pyro powders	----	5 mg/m ³	10 mg/m ³	----	----
Welding fumes	----	5 mg/m ³	10 mg/m ³	----	----
Soluble salts	----	2 mg/m ³	4 mg/m ³	----	----
Alkyls (NOC)	----	2 mg/m ³	4 mg/m ³	----	----
Aluminum oxide (Alundum, Corundum)	7429-90-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
4-Aminodiphenyl (see WAC 296-62-073)	92-67-1	----	----	----	----
2-Aminoethanol (Ethanolamine)	141-43-5	3 ppm	6 ppm	----	----
2-Aminopyridine	504-29-0	0.5 ppm	1.5 ppm	----	----
Amitrole	61-82-5	0.2 mg/m ³	0.6 mg/m ³	----	----
Ammonia	7664-41-7	25 ppm	35 ppm	----	----
Ammonium chloride, fume	12125-02-9	10 mg/m ³	20 mg/m ³	----	----
Ammonium sulfamate (Ammate)	7773-06-0	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5.0 mg/m ³	10 mg/m ³	----	----
n-Amyl acetate	628-63-7	100 ppm	150 ppm	----	----
sec-Amyl acetate	626-38-0	125 ppm	156 ppm	----	----
Aniline and homologues	62-53-3	2 ppm	4 ppm	----	X
Anisidine (o, p-isomers)	29191-52-4	0.1 ppm	0.3 ppm	----	X
Antimony and compounds (as Sb)	7440-36-0	0.5 mg/m ³	1.5 mg/m ³	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
ANTU (alpha Naphthyl thiourea)	86-88-4	0.3 mg/m ³	0.9 mg/m ³	----	----
Argon	7440-37-1	Simple asphyxiant	----	----	----
Arsenic, organic compounds (as As)	7440-38-2	0.2 mg/m ³	0.6 mg/m ³	----	----
Arsenic, inorganic compounds (as As) (when use is covered by WAC 296-62- 07347)	7440-38-2	0.01 mg/m ³	----	----	----
Arsenic, inorganic compounds (as As) (when use is not covered by WAC 296-62-07347)	7440-38-2	0.2 mg/m ³	0.6 mg/m ³	----	----
Arsine	7784-42-1	0.05 ppm	0.15 ppm	----	----
Asbestos (see WAC 296-62-077)	----	----	----	----	----
Asphalt (Petroleum fumes)	8052-42-4	5 mg/m ³	10 mg/m ³	----	----
Atrazine	1912-24-9	5 mg/m ³	10 mg/m ³	----	----
Azinphos methyl (Guthion)	86-50-0	0.2 mg/m ³	0.6 mg/m ³	----	X
Azodrin (Monocrotophos)	6923-22-4	0.25 mg/m ³	0.75 mg/m ³	----	----
Barium, soluble compounds (as Ba)	7440-39-3	0.5 mg/m ³	1.5 mg/m ³	----	----
Barium sulfate	7727-43-7	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Baygon (Propoxur)	114-26-1	0.5 mg/m ³	1.5 mg/m ³	----	----
Benomyl	17804- 35-2	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Benzene (see WAC 296-62- 07523)	71-43-2	1 ppm	5 ppm	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Benzidine (see WAC 296-62-073)	92-87-5	----	----	----	----
p-Benzoquinone (Quinone)	106-51-4	0.1 ppm	0.3 ppm	----	----
Benzo(a) pyrene (Coal tar pitch volatiles)	65996-93-2	0.2 mg/m ³	0.6 mg/m ³	----	----
Benzoyl peroxide	94-36-0	5 mg/m ³	10 mg/m ³	----	----
Benzyl chloride	100-44-7	1ppm	3 ppm	----	----
Beryllium and beryllium compounds (as Be)	7440-41-7	0.002 mg/m ³	0.005 mg/m ³ (30 min.)	0.025 mg/ m ³	----
Biphenyl (Diphenyl)	92-52-4	0.2 ppm	0.6 ppm	----	----
Bismuth telluride, undoped	1304-82-1	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Bismuth telluride, Se-doped	----	5 mg/m ³	10 mg/m ³	----	----
Borates, tetra, sodium salts	----	----	----	----	----
Anhydrous	1330-43-4	1 mg/m ³	3 mg/m ³	----	----
Decahydrate	1303-96-4	5 mg/m ³	10 mg/m ³	----	----
Pentahydrate	12179-04-3	1 mg/m ³	3 mg/m ³	----	----
Boron oxide	1303-86-2	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Boron tribromide	10294-33-4	----	----	1 ppm	----
Boron trifluoride	6737-07-2	----	----	1 ppm	----
Bromacil	314-40-9	1 ppm	3 ppm	----	----
Bromine	7726-95-6	0.1 ppm	0.3 ppm	----	----
Bromine pentafluoride	7789-30-2	0.1 ppm	0.3 ppm	----	----
Bromochloromethane (Chlorobromom-thane)	74-97-5	200 ppm	250 ppm	----	----
Bromoform	15-25-2	0.5 ppm	1.5 ppm	----	X
Butadiene (1,3-butadiene)	106-99-0	1 ppm	5 ppm	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Butane	106-97-8	800 ppm	1,000 ppm	----	----
Butanethiol (Butyl mercaptan)	109-79-5	0.5 ppm	1.5 ppm	----	----
2-Butanone (Methyl ethyl ketone)	78-93-3	200 ppm	300 ppm	----	----
2-Butoxy ethanol (Butyl cellosolve)	111-76-2	25 ppm	38 ppm	----	X
n-Butyl acetate	123-86-4	150 ppm	200 ppm	----	----
sec-Butyl acetate	105-46-4	200 ppm	250 ppm	----	----
tert-Butyl acetate	540-88-5	200 ppm	250 ppm	----	----
Butyl acrylate	141-32-2	10 ppm	20 ppm	----	----
n-Butyl alcohol	71-36-3	----	----	50 ppm	X
sec-Butyl alcohol	78-92-2	100 ppm	150 ppm	----	----
tert-Butyl alcohol	75-65-0	100 ppm	150 ppm	----	----
Butylamine	109-73-9	----	----	5 ppm	X
Butyl cellosolve (2-Butoxy ethanol)	111-76-2	25 ppm	38 ppm	----	----
tert-Butyl chromate (as CrOs)	1189-85-1	----	----	0.1 mg/m ³	X
n-Butyl glycidyl ether (BGE)	2426-08-6	25 ppm	38 ppm	----	----
n-Butyl lactate	138-22-7	5 ppm	10 ppm	---	----
Butyl mercaptan	109-79-5	0.5 ppm	1.5 ppm	----	----
o-sec-Butylphenol	89-72-5	5 ppm	10 ppm	----	X
p-tert-Butyl-toluene	98-51-1	10 ppm	20 ppm	----	----
Cadmium oxide fume (as Cd) (see WAC 296-62-074)	1306-19-0	0.005 mg/m ³	----	----	----
Cadmium dust and salts (as Cd) (see WAC 296-62-074)	7440-43-9	0.005 mg/m ³	----	----	----
Calcium arsenate (see WAC 296-62-07347)	----	0.01 mg/m ³	----	----	----
Calcium carbonate	1317-65-3	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Calcium cyanamide	156-62-7	0.5 mg/m ³	1.5 mg/m ³	----	----
Calcium hydroxide	1305-62-0	5 mg/m ³	10 mg/m ³	----	----
Calcium oxide	1305-78-8	2 mg/m ³	4 mg/m ³	----	----
Calcium silicate	1344-95-2	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Calcium sulfate	7778-18-9	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Camphor (synthetic)	76-22-2	2 mg/m ³	4 mg/m ³	----	----
Caprolactam	105-60-2	----	----	----	----
Dust	----	1 mg/m ³	3 mg/m ³	----	----
Vapor	----	5 ppm	10 ppm	----	----
Captafol (Difolatan)	2425-06-1	0.1 mg/m ³	0.3 mg/m ³	----	X
Captan	133-06-2	5 mg/m ³	10 mg/m ³	----	----
Carbaryl (Sevin)	63-25-2	5 mg/m ³	10 mg/m ³	----	----
Carbofuran (Furadon)	1563-66-2	0.1 mg/m ³	0.3 mg/m ³	----	----
Carbon black	1333-86-4	3.5 mg/m ³	7 mg/m ³	----	----
Carbon dioxide	124-38-9	5,000 ppm	30,000 ppm	----	----
Carbon disulfide	75-15-0	4 ppm	12 ppm	----	X
Carbon monoxide	630-08-0	35 ppm	200 ppm (5 min.)	1,500 ppm	----
Carbon tetrabromide	558-13-4	0.1 ppm	0.3 ppm	----	----
Carbon tetrachloride (Tetrachloro-methane)	56-23-5	2 ppm	4 ppm	----	X
Carbonyl chloride (Phosgene)	7803-51-2	0.1 ppm	0.3 ppm	----	----
Carbonyl fluoride	353-50-4	2 ppm	5 ppm	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Catechol (Pyrocatechol)	120-80-9	5 ppm	10 ppm	----	X
Cellosolve acetate (2-Ethoxyethylacetate)	111-15-9	5 ppm	10 ppm	----	X
Cellulose (paper fiber)	9004-34-6	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Cesium hydroxide	21351-79-1	2 mg/m ³	4 mg/m ³	----	----
Chlordane	57-74-9	0.5 mg/m ³	1.5 mg/m ³	----	X
Chlorinated camphene (Toxaphen)	8001-35-2	0.5 mg/m ³	1 mg/m ³	----	X
Chlorinated diphenyl oxide	55720-99-5	0.5 mg/m ³	1.5 mg/m ³	----	----
Chlorine	7782-50-5	0.5 ppm	----	1 ppm	----
Chlorine dioxide	10049-04-4	0.1 ppm	0.3 ppm	----	----
Chlorine trifluoride	7790-91-2	----	----	0.1 ppm	----
Chloroacetaldehyde	107-20-0	----	----	1 ppm	----
a-Chloroacetophenone (Phenacyl chloride)	532-21-4	0.05 ppm	0.15 ppm	----	----
Chloroacetyl chloride	79-04-9	0.05 ppm	0.15 ppm	----	----
Chlorobenzene (Monochlorobenzene)	108-90-7	75 ppm	113 ppm	----	----
o-Chlorobenzylidene malononitrile (OCBM)	2698-41-1	----	----	0.05 ppm	X
Chlorobromomethane	74-97-5	200 ppm	250 ppm	----	----
2-Chloro-1, 3-butadiene (beta-Chloroprene)	126-99-8	10 ppm	20 ppm	----	X
Chlorodifluoromethane	75-45-6	1,000 ppm	1,250 ppm	----	----
Chlorodiphenyl (42% Chlorine) (PCB) (Polychlorobiphenyls)	53469-21-9	1 mg/m ³	3 mg/m ³	----	X



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Chlorodiphenyl (54% Chlorine) (Polychloro-biphenyls (PCB))	11097-69-1	0.5 mg/m ³	1.5 mg/m ³	----	X
1-Chloro-2, 3-epoxypropane (Epichlorhydrin)	106-89-8	2 ppm	4 ppm	----	X
2-Chloroethanol (Ethylene chlorohydrin)	107-07-3	----	----	1 ppm	X
Chloroethylene (vinyl chloride) (See WAC 296-62-07329)	75-01-4	1 ppm	5 ppm	----	----
Chloroform (Trichloromethane)	67-66-3	2 ppm	4 ppm	----	----
1-Chloro-1-nitropropane	600-25-9	2 ppm	4 ppm	----	----
bis-Chloromethyl ether (see WAC 296-62-073)	542-88-1	----	----	----	----
Chloromethyl methyl ether (Methyl chloromethyl ether) (see WAC 296-62-073)	107-30-2	----	----	----	----
Chloropentafluoroethane	76-15-3	1,000 ppm	1,250 ppm	----	----
Chloropicrin (Nitrotrichloromethane)	76-06-2	0.1 ppm	0.3 ppm	----	----
beta-Chloroprene (2-Chloro-1,3-butadiene)	126-99-8	10 ppm	20 ppm	----	X
o-Chlorostyrene	2039-87-4	50 ppm	75 ppm	----	----
o-Chlorotoluene	95-49-8	50 ppm	75 ppm	----	----
2-Chloro-6-trichloromethyl pyridine (Nitrapyrin)	1929-82-4	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Chlorpyrifos	2921-88-2	0.2 mg/m ³	0.6 mg/m ³	----	X
Chromic acid and chromates (as CrO ₃)	Varies with compound	0.1 mg/m ³	0.3 mg/m ³	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Chromium, soluble, chromic and chromous salts (as Cr)	7440-47-3	0.5 mg/m ³	1.5 mg/m ³	----	---
Chromium (VI) compounds (as Cr)	----	0.05 mg/m ³	0.15 mg/m ³	----	----
Chromium metal and insoluble salts	7440-47-3	0.5 mg/m ³	1.5 mg/m ³	----	----
Chromyl chloride	14977-61-8	0.025 ppm	0.075 ppm	----	----
Chrysene (Coal tar pitch volatiles)	65996-93-2	0.2 mg/m ³	0.6 mg/m ³	----	----
Clopidol	2971-90-6	----	----	----	----
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Coal dust (less than 5% SiO ₂)	----	----	----	----	----
Respirable fraction	----	2 mg/m ³	4 mg/m ³	----	----
Coal dust (greater than or equal to 5% SiO ₂)	----	----	----	----	----
Respirable fraction	----	0.1 mg/m ³	0.3 mg/m ³	----	----
Coal tar pitch volatiles (benzene soluble fraction) (Particulate polycyclic aromatic hydrocarbons)	65996-93-2	0.2 mg/m ³	0.6 mg/m ³	----	----
Cobalt, metal fume & dust (as Co)	7440-48-4	0.05 mg/m ³	0.15 mg/m ³	----	----
Cobalt carbonyl (as Co)	10210-68-1	0.1 mg/m ³	0.3 mg/m ³	----	----
Cobalt hydrocarbyl (as Co)	16842-03-8	0.1 mg/m ³	0.3 mg/m ³	----	----
Coke oven emissions (see WAC 296-62-200)	----	0.15 mg/m ³	----	----	----
Copper (as Cu)	7440-50-8	----	----	----	----
Fume	----	0.1 mg/m ³	0.3 mg/m ³	----	----
Dusts and mists	----	1 mg/m ³	3 mg/m ³	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Cotton dust (raw) (waste sorting, blending, cleaning, willowing and garetting) (see WAC 296-62-14533)	---	1 mg/m ³	---	---	---
Corundum (Aluminum oxide)	7429-90-5	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Crag herbicide (Sesone, Sodium-2, 4-dichloro-phenoxyethyl sulfate)	136-78-7	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Cresol (all isomers)	1319-77-3	5 ppm	10 ppm	---	X
Crotonaldehyde	123-73-9; 4170-30-3	2 ppm	4 ppm	---	---
Crufomate	299-86-5	5 mg/m ³	10 mg/m ³	---	---
Cumene	98-82-8	50 ppm	75 ppm	---	X
Cyanamide	420-04-2	2 mg/m ³	4 mg/m ³	---	---
Cyanide (as CN)	Varies with compound	5 mg/m ³	10 mg/m ³	---	X
Cyanogen	460-19-5	10 ppm	20 ppm	---	---
Cyanogen chloride	506-77-4	---	---	0.3 ppm	---
Cyclohexane	110-82-7	300 ppm	375 ppm	---	---
Cyclohexanol	108-93-0	50 ppm	75 ppm	---	X
Cyclohexanone	108-94-1	25 ppm	38 ppm	---	X
Cyclohexene	110-83-8	300 ppm	375 ppm	---	---
Cyclohexylamine	108-91-8	10 ppm	20 ppm	---	---
Cyclonite (RDX)	121-82-4	1.5 mg/m ³	3.0 mg/m ³	---	X
Cyclopentadiene	542-92-7	75 ppm	113 ppm	---	---
Cyclopentane	287-92-3	600 ppm	750 ppm	---	---

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Cyhexatin (Tricyclohexyltin hydroxide)	13121-70-5	5 mg/m ³	10 mg/m ³	----	----
2,4-D (Dichlorophenoxy-acetic acid)	94-75-7	10 mg/m ³	20 mg/m ³	----	----
DBCP (1,2-Dibromo-3-chloropropane) (See WAC 296-62-07342)	96-12-8	0.001 ppm	----	0.005 ppm	----
DDT (Dichlorodiphenyltrichloroethane)	50-29-3	1 mg/m ³	3 mg/m ³	----	X
DDVP, (Dichlorvos)	62-73-7	0.1 ppm	0.3 ppm	----	X
Dasanit (Fensulfothion)	115-90-2	0.1 mg/m ³	0.3 mg/m ³	----	----
Decaborane	17702-41-9	0.05 ppm	0.15 ppm	----	X
Demeton	8065-48-3	0.01 ppm	0.03 ppm	----	X
Diacetone alcohol (4-hydroxy-4-methyl-2-pentanone)	123-42-2	50 ppm	75 ppm	----	----
1, 2-Diaminoethane (Ethylenediamine)	107-15-3	10 ppm	20 ppm	----	----
Diazinon	333-41-5	0.1 mg/m ³	0.3 mg/m ³	----	X
Diazomethane	334-88-3	0.2 ppm	0.6 ppm	----	----
Diborane	19287-45-7	0.1 ppm	0.3 ppm	----	----
Dibrom (see Naled)	300-76-5	3 mg/m ³	6 mg/m ³	----	X
1, 2-Dibromo-3-chloropropane (DBCP) (see WAC 296-62-07342)	96-12-8	0.001 ppm	----	0.005 ppm	----
2-N-Dibutylamino ethanol	102-81-8	2 ppm	4 ppm	----	X
Dibutyl phosphate	107-66-4	1 ppm	2 ppm	----	----
Dibutyl phthalate	84-74-2	5 mg/m ³	10 mg/m ³	----	----
Dichloroacetylene	7572-29-4	----	----	0.1 ppm	----
o-Dichlorobenzene	95-50-1	----	----	50 ppm	----
p-Dichlorobenzene	106-46-7	75 ppm	110 ppm	----	----
3, 3'-Dichlorobenzidine (see WAC 296-62-073)	91-94-1	----	----	----	----

1 • 8 0 0 • 4 B E S A F E (1 • 8 0 0 • 4 2 3 • 7 2 3 3)



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Dichlorodiphenyltrichloroethane (DDT)	50-29-3	1 mg/m ³	3 mg/m ³	----	X
Dichlorodifluoromethane	75-71-8	1,000 ppm	1,250 ppm	----	----
1, 3-Dichloro-5, 5-dimethylhydantoin	118-52-5	0.2 mg/m ³	0.4 mg/m ³	----	----
1, 1-Dichloroethane (Ethylidene chloride)	75-34-3	100 ppm	150 ppm	----	----
1, 2-Dichloroethane (Ethylene dichloride)	107-06-2	1 ppm	2 ppm	----	----
1, 1-Dichloroethylene (Vinylidene chloride)	75-35-4	1 ppm	3 ppm	----	----
1, 2-Dichloroethylene (Acetylene dichloride)	540-59-0	200 ppm	250 ppm	----	----
Dichloroethyl ether	111-44-4	5 ppm	10 ppm	----	X
Dichlorofluoromethane	75-43-4	10 ppm	20 ppm	----	----
Dichloromethane (Methylene chloride) (See WAC 296-62-07470)	75-09-2	25 ppm	125 ppm	----	----
1, 1-Dichloro-1-nitroethane	594-72-9	2 ppm	10 ppm	----	----
Dichlorophenoxyacetic acid (2, 4-D)	94-75-7	10 mg/m ³	20 mg/m ³	----	----
1, 2-Dichloropropane (Propylene dichloride)	78-87-5	75 ppm	110 ppm	----	----
Dichloropropene	542-75-6	1 ppm	3 ppm	----	X
2, 2-Dichloropropionic acid	75-99-0	1 ppm	3 ppm	----	----
Dichlorotetrafluoroethane	76-14-2	1,000 ppm	1,250 ppm	----	----
Dichlorvos (DDVP)	62-73-7	0.1 ppm	0.3 ppm	----	X
Dicrotophos	141-66-2	0.25 mg/m ³	0.75 mg/m ³	----	X
Dicyclopentadiene	77-73-6	5 ppm	10 ppm	----	----
Dicyclopentadienyl iron	102-54-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Dieldrin	60-57-1	0.25 mg/m ³	0.75 mg/m ³	----	X

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Diethanolamine	111-42-2	3 ppm	6 ppm	----	----
Diethylamine	109-89-7	10 ppm	25 ppm	----	----
2-Diethylaminoethanol	100-37-8	10 ppm	20 ppm	----	X
Diethylene triamine	111-40-0	1 ppm	3 ppm	----	X
Diethyl ether (Ethyl ether)	60-29-7	400 ppm	500 ppm	----	----
Diethyl ketone	96-22-0	200 ppm	250 ppm	----	----
Diethyl phthalate	84-66-2	5 mg/m ³	10 mg/m ³	----	----
Difluorodibromomethane	75-61-6	100 ppm	150 ppm	----	----
Difolatan (Captafol)	2425-06-1	0.1 mg/m ³	0.3 mg/m ³	----	X
Diglycidyl ether (DGE)	2238-07-5	0.1 ppm	0.3 ppm	----	----
Dihydroxybenzene (Hydroquinone)	123-31-9	2 mg/m ³	4 mg/m ³	----	----
Diisobutyl ketone (2, 6-Dimethylheptanone)	108-83-8	25 ppm	38 ppm	----	----
Diisopropylamine	108-18-9	5 ppm	10 ppm	----	X
Dimethoxymethane (Methylal)	109-87-5	1,000 ppm	1,250 ppm	----	----
Dimethyl acetamide	127-19-5	10 ppm	20 ppm	----	X
Dimethylamine	124-40-3	10 ppm	20 ppm	----	----
4-Dimethylaminoazo benzene (see WAC 296-62-073)	60-11-7	----	----	----	----
Dimethylaminobenzene (Xyldene)	1300-73-8	2 ppm	4 ppm	----	X
Dimethylaniline (N, N-Dimethylaniline)	121-69-7	5 ppm	10 ppm	----	X
Dimethylbenzene (Xylene)	1300-73-8	100 ppm	150 ppm	----	----
Dimethyl-1, 2-dibromo-2, 2-dichloroethyl phosphate (Naled)	300-76-5	3 mg/m ³	6 mg/m ³	----	X
Dimethylformamide	68-12-2	10 ppm	20 ppm	----	X
2, 6-Dimethylheptanone (Diisobutyl ketone)	108-83-8	25 ppm	38 ppm	----	----
1, 1-Dimethylhydrazine	57-14-7	0.5 ppm	1.5 ppm	----	X

1 • 8 0 0 • 4 B E S A F E (1 • 8 0 0 • 4 2 3 • 7 2 3 3)



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Dimethyl phthalate	131-11-3	5 mg/m ³	10 mg/m ³	----	----
Dimethyl sulfate	77-78-1	0.1 ppm	0.3 ppm	----	X
Dinitolmide (3, 5-Dinitro-o-toluamide)	148-01-6	5 mg/m ³	10 mg/m ³	----	----
Dinitrobenzene (all isomers - alpha, meta and para)	528-29-0; 99-65-0; 100-25-4	0.15 ppm	0.45 ppm	----	X
Dinitro-o-cresol	534-52-1	0.2 mg/m ³	0.6 mg/m ³	----	X
3, 5-Dinitro-o-toluamide (Dinitolmide)	148-01-6	5 mg/m ³	10 mg/m ³	----	----
Dinitrotoluene	25321-14-6	1.5 mg/m ³	3 mg/m ³	----	X
Dioxane (Diethylene dioxide)	123-91-1	25 ppm	38 ppm	----	X
Dioxathion	78-34-2	0.2 mg/m ³	0.6 mg/m ³	----	X
Diphenyl (Biphenyl)	92-52-4	0.2 ppm	0.6 ppm	----	----
Diphenylamine	122-39-4	10 mg/m ³	20 mg/m ³	----	----
Diphenylmethane diisocyanate (Methylene bisphenylisocyanate (MDI))	101-68-8	----	----	0.02 ppm	----
Dipropylene glycol methyl ether	34590-94-8	100 ppm	150 ppm	----	X
Dipropyl ketone	123-19-3	50 ppm	75 ppm	----	----
Diquat	85-00-7	0.5 mg/m ³	1.5 mg/m ³	----	----
Di-sec, Octyl phthalate (Di-2-ethylhexylphthalate)	117-81-7	5 mg/m ³	10 mg/m ³	----	----
Disulfiram	97-77-8	2 mg/m ³	4 mg/m ³	----	----
Disulfoton	298-04-4	0.1 mg/m ³	0.3 mg/m ³	----	X
2, 6-Di-tert-butyl-p-cresol	128-37-0	10 mg/m ³	20 mg/m ³	----	----
Diuron	330-54-1	10 mg/m ³	20 mg/m ³	----	----
Divinyl benzene	1321-74-0	10 ppm	20 ppm	----	----
Emery	12415-34-8	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Endosulfan (Thiodan)	115-29-7	0.1 mg/m ³	0.3 mg/m ³	----	X
Endrin	72-20-8	0.1 mg/m ³	0.3 mg/m ³	----	X
Epichlorhydrin (1-Chloro-2, 3-epoxypropane)	106-89-8	2 ppm	4 ppm	----	X
EPN	2104-64-5	0.5 mg/m ³	1.5 mg/m ³	----	X
1, 2-Epoxypropane (Propylene oxide)	75-56-9	20 ppm	30 ppm	----	---
2, 3-Epoxy-1-propanol (Glycidol)	556-52-5	25 ppm	38 ppm	----	---
Ethane	----	Simple asphyxiant	----	----	---
Ethanethiol (Ethyl mercaptan)	75-08-1	0.5 ppm	1.5 ppm	----	---
Ethanol (Ethyl alcohol)	64-17-5	1,000 ppm	1,250 ppm	----	---
Ethanolamine (2-Aminoethanol)	141-43-5	3 ppm	6 ppm	----	---
Ethion	563-12-2	0.4 mg/m ³	1.2 mg/m ³	----	X
2-Ethoxyethanol (Glycol monoethyl ether)	110-80-5	5 ppm	10 ppm	----	X
2-Ethoxyethyl acetate (Cellosolve acetate)	111-15-9	5 ppm	10 ppm	----	X
Ethyl acetate	141-78-6	400 ppm	500 ppm	----	---
Ethyl acrylate	140-88-5	5 ppm	25 ppm	----	X
Ethyl alcohol (ethanol)	64-17-5	1,000 ppm	1,250 ppm	----	---
Ethylamine	75-04-07	10 ppm	20 ppm	----	---
Ethyl amyl ketone (5-Methyl-3-heptanone)	541-85-5	25 ppm	38 ppm	----	---
Ethyl benzene	100-41-4	100 ppm	125 ppm	----	---
Ethyl bromide	74-96-4	200 ppm	250 ppm	----	---
Ethyl butyl ketone (3-Heptanone)	106-35-4	50 ppm	75 ppm	----	---
Ethyl chloride	75-00-3	1,000 ppm	1,250 ppm	----	---



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Ethylene	74-85-1	Simple asphyxiant	----	----	----
Ethylene chlorohydrin (2-Chloroethanol)	107-07-3	----	----	1 ppm	X
Ethylenediamine (1,2-Diaminoethane)	107-15-3	10 ppm	20 ppm	----	X
Ethylene dibromide	106-93-4	0.1 ppm	0.5 ppm	----	----
Ethylene dichloride (1,2-Dichloroethane)	107-06-2	1 ppm	2 ppm	----	----
Ethylene glycol	107-21-1	----	----	50 ppm	----
Ethylene glycol dinitrate	628-96-6	----	0.1 mg/m ³	----	X
Ethylene glycol monomethyl ether acetate (Methyl cellosolve acetate)	----	5 ppm	10 ppm	----	X
Ethyleneimine (see WAC 296-62-073)	151-56-4	----	----	----	X
Ethylene oxide (see WAC 296-62-07359)	75-21-8	1 ppm	5 ppm	----	----
Ethyl ether (Diethyl ether)	60-29-7	400 ppm	500 ppm	----	----
Ethyl formate	109-94-4	100 ppm	125 ppm	----	----
Ethyldine chloride (1, 1-Dichloroethane)	107-06-2	1 ppm	2 ppm	----	----
Ethyldene norbornene	16219-75-3	----	----	5.0 ppm	----
Ethyl mercaptan (Ethanethiol)	75-08-1	0.5 ppm	1.5 ppm	----	----
n-Ethylmorpholine	100-74-3	5 ppm	10 ppm	----	X
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	541-85-5	25 ppm	38 ppm	----	----
Ethyl silicate	78-10-4	10 ppm	20 ppm	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Fenamiphos	22224-92-6	0.1 mg/m ³	0.3 mg/m ³	----	X
Fensulfothion (Dasanit)	115-90-2	0.1 mg/m ³	0.3 mg/m ³	----	----
Fenthion	55-38-9	0.2 mg/m ³	0.6 mg/m ³	----	X
Ferbam	----	----	----	----	----
Total particulate	14484-64-1	10 mg/m ³	20 mg/m ³	----	----
Ferrovanadium dust	12604-58-9	1 mg/m ³	3 mg/m ³	----	----
Fluorides (as F)	Varies with compound	2.5 mg/m ³	5 mg/m ³	----	----
Fluorine	7782-41-4	0.1 ppm	0.3 ppm	----	----
Fluorotrichloromethane (see Trichlorofluoro methane)	75-69-4	----	----	1,000 ppm	----
Fonofos	944-22-9	0.1 mg/m ³	0.3 mg/m ³	----	X
Formaldehyde (see WAC 296-62-07540)	50-00-0	0.75 ppm	2 ppm	----	----
Formamide	75-12-7	20 ppm	30 ppm	----	----
Formic acid	64-18-6	5 ppm	10 ppm	----	----
Furadon (carbofuran)	1563-66-2	0.1 mg/m ³	0.3 mg/m ³	----	----
Furfural	98-01-1	2 ppm	4 ppm	----	X
Furfuryl alcohol	98-00-0	10 ppm	15 ppm	----	X
Gasoline	8006-61-9	300 ppm	500 ppm	----	----
Germanium tetrahydride	7782-65-2	0.2 ppm	0.6 ppm	----	----
Glass, fibrous or dust	----	10 mg/m ³	20 mg/m ³	----	----
Glutaraldehyde	111-30-8	----	----	0.2 ppm	----
Glycerin mist	56-81-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL		Skin
Glycidol (2, 3-Epoxy-1-propanol)	556-52-5	25 ppm	38 ppm	----	----
Glycol monoethyl ether (2-Ethoxyethanol)	110-80-5	5 ppm	10 ppm	----	X
Grain dust (oat, wheat, barley)	----	10 mg/m ³	20 mg/m ³	----	----
Graphite, natural	7782-42-5	----	----	----	----
Respirable particulate	----	2.5 mg/m ³	5 mg/m ³	----	----
Graphite, synthetic	----	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Guthion (Azinphosmethyl)	86-50-0	0.2 mg/m ³	0.6 mg/m ³	----	X
Gypsum	13397-24-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Hafnium	7440-58-6	0.5 mg/m ³	1.5 mg/m ³	----	----
Helium	----	Simple asphyxiant	----	----	----
Heptachlor	76-44-8	0.5 mg/m ³	1.5 mg/m ³	----	X
Heptane (n-heptane)	142-82-5	400 ppm	500 ppm	----	----
2-Heptanone (Methyl n-amyl ketone)	110-43-0	50 ppm	75 ppm	----	----
3-Heptanone (Ethyl butyl ketone)	106-35-4	50 ppm	75 ppm	----	----
Hexachlorobutadiene	87-68-3	0.02 ppm	0.06 ppm	----	X
Hexachlorocyclopentadiene	77-47-4	0.01 ppm	0.03 ppm	----	----
Hexachloroethane	67-72-1	1 ppm	3 ppm	----	X
Hexachloronaphthalene	1335-87-1	0.2 mg/m ³	0.6 mg/m ³	----	X
Hexafluoroacetone	684-16-2	0.1 ppm	0.3 ppm	----	X

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Hexane	---	---	---	---	---
n-hexane	110-54-3	50 ppm	75 ppm	---	---
other isomers	Varies with compound	500 ppm	1,000 ppm	---	---
2-Hexanone (Methyl-n-butyl ketone)	591-78-6	5 ppm	10 ppm	---	---
Hexone (Methyl isobutyl ketone)	108-10-1	50 ppm	75 ppm	---	---
sec-Hexyl acetate	108-84-9	50 ppm	75 ppm	---	---
Hexylene glycol	107-41-5	---	---	25 ppm	---
Hydrazine	302-01-2	0.1 ppm	0.3 ppm	---	X
Hydrogen	---	Simple asphyxiant	---	---	---
Hydrogenated terphenyls	61788-32-7	0.5 ppm	1.5 ppm	---	---
Hydrogen bromide	10035-10-6	---	---	3.0 ppm	---
Hydrogen chloride	7647-01-0	---	---	5.0 ppm	---
Hydrogen cyanide	74-90-8	---	4.7 ppm	---	X
Hydrogen fluoride	7664-39-3	---	---	3 ppm	---
Hydrogen peroxide	7722-84-1	1 ppm	3 ppm	---	---
Hydrogen selenide (as Se)	7783-07-5	0.05 ppm	0.15 ppm	---	---
Hydrogen sulfide	7783-06-4	10 ppm	15 ppm	---	---
Hydroquinone (Dihydroxybenzene)	123-31-9	2 mg/m ³	4 mg/m ³	---	---
4-Hydroxy-4-methyl-2-pentanone (Diacetone alcohol)	123-42-2	50 ppm	75 ppm	---	---
2-Hydroxypropyl acrylate	99-61-1	0.5 ppm	1.5 ppm	---	X
Indene	95-13-6	10 ppm	20 ppm	---	---
Indium and compounds (as In)	7440-74-6	0.1 mg/m ³	0.3 mg/m ³	---	---



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Iodine	7553-56-2	----	----	0.1 ppm	----
Iodoform	75-47-8	0.6 ppm	1.8 ppm	----	----
Iron oxide dust and fume (as Fe)	1309-37-1	----	----	----	----
Total particulate	----	5 mg/m ³	10 mg/m ³	----	----
Iron pentacarbonyl (as Fe)	13463-40-6	0.1 ppm	0.2 ppm	----	----
Iron salts, soluble (as Fe)	Varies with compound	1 mg/m ³	3 mg/m ³	----	----
Isoamyl acetate	123-92-2	100 ppm	150 ppm	----	----
Isoamyl alcohol (primary and secondary)	123-51-3	100 ppm	125 ppm	----	----
Isobutyl acetate	110-19-0	150 ppm	188 ppm	----	----
Isobutyl alcohol	78-83-1	50 ppm	75 ppm	----	----
Isooctyl alcohol	26952-21-6	50 ppm	75 ppm	----	X
Isophorone	78-59-1	4 ppm	----	5 ppm	----
Isophorone diisocyanate	4098-71-9	0.005 ppm	0.02 ppm	----	X
Isopropoxyethanol	109-59-1	25 ppm	38 ppm	----	----
Isopropyl acetate	108-21-4	250 ppm	310 ppm	----	----
Isopropyl alcohol	67-63-0	400 ppm	500 ppm	----	----
Isopropylamine	75-31-0	5 ppm	10 ppm	----	----
N-Isopropylaniline	768-52-5	2 ppm	4 ppm	----	X
Isopropyl ether	108-20-3	250 ppm	313 ppm	----	----
Isopropyl glycidyl ether (IGE)	4016-14-2	50 ppm	75 ppm	----	----
Kaolin	----	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Ketene	463-51-4	0.5 mg/m ³	1.5 mg/m ³	----	----
Lannate (Methomyl)	16752-77-5	2.5 mg/m ³	5 mg/m ³	----	----
Lead, inorganic (as Pb) (see WAC 296-62-07521 and 296-155-176)	7439-92-1	0.05 mg/m ³	----	----	----
Lead arsenate (as Pb) (see WAC 296-62-07347)	3687-31-8	0.05 mg/m ³	----	----	----
Lead chromate (as Pb)	7758-97-6	0.05 mg/m ³	----	----	----
Limestone	1317-65-3	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Lindane	58-89-9	0.5 mg/m ³	1.5 mg/m ³	----	X
Lithium hydride	7580-67-8	0.025 mg/m ³	0.075 mg/m ³	----	----
L.P.G. (liquefied petroleum gas)	68476-85-7	1,000 ppm	1,250 ppm	----	----
Magnesite	546-93-0	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Magnesium oxide fume	1309-48-4	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Malathion	121-75-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	X
Maleic anhydride	108-31-6	0.25 ppm	0.75 ppm	----	----
Manganese and compounds (as Mn)	7439-96-5	----	----	5 mg/m ³	----
Manganese cyclopentadienyl tricarbonyl (as Mn)	12079-65-1	0.1 mg/m ³	0.3 mg/m ³	----	X



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Manganese tetroxide and fume (as Mn)	7439-96-5	1 mg/m ³	3 mg/m ³	----	----
Marble	1317-65-3	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
MBOCA (4, 4'-Methylene bis (2-chloro-aniline)) (see WAC 296-62-073)	101-14-4	----	----	----	X
MDA (4, 4-Methylene dianiline) (see WAC 296-62-076)	101-77-9	0.01 ppm	0.1 ppm	----	X
MDI (Methylene bisphenyl isocyanate) (Diphenylmethane diisocyanate)	101-68-8	----	----	0.02 ppm	----
MEK (Methyl ethyl ketone) (2-Butanone)	78-93-3	200 ppm	300 ppm	----	----
MEKP (Methyl ethyl ketone peroxide)	1338-23-4	----	----	0.2 ppm	----
Mercury (as Hg)	7439-97-6	----	----	----	----
Aryl and inorganic	----	0.1 mg/m ³	0.3 mg/m ³	----	X
Organic-alkyl compounds	----	0.01 mg/m ³	0.03 mg/m ³	----	X
Vapor	----	0.05 mg/m ³	0.15 mg/m ³	----	X

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Mesityl oxide	141-79-7	15 ppm	25 ppm	----	----
Methacrylic acid	79-41-4	20 ppm	30 ppm	----	X
Methane	----	Simple asphyxiant	----	----	----
Methanethiol (Methyl mercaptan)	74-93-1	0.5 ppm	1.5 ppm	----	----
Methanol (Methyl alcohol)	67-56-1	200 ppm	250 ppm	----	X
Methomyl (Iannate)	16752-77-5	2.5 mg/m ³	5 mg/m ³	----	----
Methoxychlor	72-43-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
2-Methoxyethanol (Methyl cellosolve)	109-86-4	5 ppm	10 ppm	----	X
2-Methoxyethyl acetate (Methyl cellosolve acetate)	110-49-6	5 ppm	10 ppm	----	X
4-Methoxyphenol	150-76-5	5 mg/m ³	10 mg/m ³	----	----
Methyl acetate	79-20-9	200 ppm	250 ppm	----	----
Methyl acetylene (propyne)	74-99-7	1,000 ppm	1,250 ppm	----	----
Methyl acetylene-propadiene mixture (MAPP)	----	1,000 ppm	1,250 ppm	----	----
Methyl acrylate	96-33-3	10 ppm	20 ppm	----	X
Methylacrylonitrile	126-98-7	1 ppm	3 ppm	----	X
Methylal (Dimethoxy-methane)	109-87-5	1,000 ppm	1,250 ppm	----	----
Methyl alcohol (methanol)	67-56-1	200 ppm	250 ppm	----	X
Methylamine	74-89-5	10 ppm	20 ppm	----	----
Methyl amyl alcohol (Methyl isobutyl carbinol)	108-11-2	25 ppm	40 ppm	----	X
Methyl n-amyl ketone (2-Heptanone)	110-43-0	50 ppm	75 ppm	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
N-Methyl aniline (Monomethyl aniline)	100-61-8	0.5 ppm	1.5 ppm	----	X
Methyl bromide	74-83-9	5 ppm	10 ppm	----	X
Methyl-n-butyl ketone (2-Hexanone)	591-78-6	5 ppm	10 ppm	----	----
Methyl cellosolve (2-Methoxyethanol)	109-86-4	5 ppm	10 ppm	----	X
Methyl cellosolve acetate (2-Methoxyethyl acetate)	110-49-6	5 ppm	10 ppm	----	X
Methyl chloride	74-87-3	50 ppm	100 ppm	----	----
Methyl chloroform (1, 1, 1-trichlorethane)	71-55-6	350 ppm	450 ppm	----	----
Methyl chloromethyl ether (chloromethyl methyl ether) (see WAC 296-62-073)	107-30-2	----	----	----	----
Methyl 2-cyanoacrylate	137-05-3	2 ppm	4 ppm	----	----
Methylcyclohexane	108-87-2	400 ppm	500 ppm	----	----
Methylcyclohexanol	25639-42-3	50 ppm	75 ppm	----	----
Methylcyclohexanone	583-60-8	50 ppm	75 ppm	----	X
Methylcyclopentadienyl manganese tricarbonyl (as Mn)	12108-13-3	0.2 mg/m ³	0.6 mg/m ³	----	X
Methyl demeton	8022-00-2	0.5 mg/m ³	1.5 mg/m ³	----	X
Methylene bisphenyl isocyanate (MDI) (Diphenylmethane)	101-68-8	----	----	0.02 ppm	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
4,4'-Methylene bis (2-chloro-aniline) (MBOCA) (see WAC 296-62-073)	101-14-4	----	----	----	X
Methylene bis (4-cyclohexylisocyanate)	5124-30-1	----	----	0.01 ppm	----
Methylene chloride (Dichloromethane) (see WAC 296-62-07470)	75-09-2	25 ppm	125 ppm	----	----
4,4-Methylene dianiline (MDA) (see WAC 296-62-076)	101-77-9	0.01 ppm	0.1 ppm	----	X
Methyl ethyl ketone (MEK) (2-Butanone)	78-93-3	200 ppm	300 ppm	----	----
Methyl ethyl ketone peroxide (MEKP)	1338-23-4	----	----	0.2 ppm	----
Methyl formate	107-31-3	100 ppm	150 ppm	----	----
5-Methyl-3-heptanone (Ethyl amyl ketone)	541-85-5	25 ppm	38 ppm	----	----
Methyl hydrazine (Monomethyl hydrazine)	60-34-4	----	----	0.2 ppm	X
Methyl iodide	74-88-4	2 ppm	4 ppm	----	X
Methyl isoamyl ketone	110-12-3	50 ppm	75 ppm	----	----
Methyl isobutyl carbinol (Methyl amyl alcohol)	108-11-2	25 ppm	40 ppm	----	X
Methyl isobutyl ketone (Hexone)	108-10-1	50 ppm	75 ppm	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Methyl isocyanate	624-83-9	0.02 ppm	0.06 ppm	----	X
Methyl isopropyl ketone	563-80-4	200 ppm	250 ppm	----	----
Methyl mercaptan (Methanethiol)	74-93-1	0.5 ppm	1.5 ppm	----	----
Methyl methacrylate	80-62-6	100 ppm	150 ppm	----	----
Methyl parathion	298-00-0	0.2 mg/m ³	0.6 mg/m ³	----	X
Methyl propyl ketone (2-Pentanone)	107-87-9	200 ppm	250 ppm	----	----
Methyl silicate	684-84-5	1 ppm	3 ppm	----	----
alpha-Methyl styrene	98-83-9	50 ppm	100 ppm	----	----
Mevinphos (Phosdrin)	7786-34-7	0.01 ppm	0.03 ppm	----	X
Metribuzin	21087-64-9	5 mg/m ³	10 mg/m ³	----	----
Mica (Silicates) Respirable fraction	12001-26-2	3 mg/m ³	6 mg/m ³	----	----
Molybdenum (as Mo)	7439-98-7	----	----	----	----
Soluble compounds	----	5 mg/m ³	10 mg/m ³	----	----
Insoluble compounds	----	10 mg/m ³	20 mg/m ³	----	----
Monochlorobenzene (Chlorobenzene)	108-90-7	75 ppm	113 ppm	----	----
Monocrotophos (Azodrin)	6923-22-4	0.25 mg/m ³	0.75 mg/m ³	----	----
Monomethyl aniline (N-Methyl aniline)	100-61-8	0.5 ppm	1.5 ppm	----	X
Monomethyl hydrazine	----	----	----	0.2 ppm	----
Morpholine	110-91-8	20 ppm	30 ppm	----	X
Naled (Dibrom)	300-76-5	3 mg/m ³	6 mg/m ³	----	X
Naphtha	8030-30-6	100 ppm	150 ppm	----	X
Naphthalene	91-20-3	10 ppm	15 ppm	----	----
alpha-Naphthylamine (see WAC 296-62-073)	134-32-7	----	----	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Beta-Naphthylamine (see WAC 296-62-073)	91-59-8	----	----	----	----
Neon	7440-01-9	Simple asphyxiant	----	----	----
Nickel carbonyl (as Ni)	13463-39-3	0.001 ppm	0.003 ppm	----	----
Nickel (as Ni)	7440-02-0	----	----	----	----
Metal and insoluble compounds	----	1 mg/m ³	3 mg/m ³	----	----
Soluble compounds	----	0.1 mg/m ³	0.3 mg/m ³	----	----
Nicotine	54-11-5	0.5 mg/m ³	1.5 mg/m ³	----	X
Nitrapyrin (2-Chloro-6 trichloromethyl pyridine)	1929-82-4	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Nitric acid	7697-37-2	2 ppm	4 ppm	----	----
Nitric oxide	10102-43-9	25 ppm	38 ppm	----	----
p-Nitroaniline	100-01-6	3 mg/m ³	6 mg/m ³	----	X
Nitrobenzene	98-95-3	1 ppm	3 ppm	----	X
4-Nitrobiphenyl (see WAC 296-62-073)	92-93-3	----	----	----	----
p-Nitrochlorobenzene	100-00-5	0.5 mg/m ³	1.5 mg/m ³	----	X
4-Nitrodiphenyl (see WAC 296-62-073)	----	----	----	----	----
Nitroethane	79-24-3	100 ppm	150 ppm	----	----
Nitrogen	7727-37-9	Simple asphyxiant	----	----	----
Nitrogen dioxide	10102-44-0	----	1 ppm	----	----
Nitrogen oxide (Nitrous oxide)	10024-97-2	50 ppm	75 ppm	----	----
Nitrogen trifluoride	7783-54-2	10 ppm	20 ppm	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Nitroglycerin	55-63-0	----	0.1 mg/m ³	----	X
Nitromethane	75-52-5	100 ppm	150 ppm	----	----
1-Nitropropane	108-03-2	25 ppm	38 ppm	----	----
2-Nitropropane	79-46-9	10 ppm	20 ppm	----	----
N-Nitrosodimethylamine (see WAC 296-62-073)	62-75-9	----	----	----	----
Nitrotoluene	----	----	----	----	----
o-isomer	88-72-2	2 ppm	4 ppm	----	X
m-isomer	98-08-2	2 ppm	4 ppm	----	X
p-isomer	99-99-0	2 ppm	4 ppm	----	X
Nitrotrichloromethane (Chloropicrin)	76-06-2	0.1 ppm	0.3 ppm	----	----
Nitrous oxide (Nitrogen oxide)	10024-97-2	50 ppm	75 ppm	----	----
Nonane	111-84-2	200 ppm	250 ppm	----	----
Octachloronaphthalene	2234-13-1	0.1 mg/m ³	0.3 mg/m ³	----	X
Octane	111-65-9	300 ppm	375 ppm	----	----
Oil mist mineral (particulate)	8012-95-1	5 mg/m ³	10 mg/m ³	----	----
Osmium tetroxide (as Os)	20816-12-0	0.0002 ppm	0.0006 ppm	----	----
Oxalic acid	144-62-7	1 mg/m ³	2 mg/m ³	----	----
Oxygen difluoride	7783-41-7	----	----	0.05 ppm	----
Ozone	10028-15-6	0.1 ppm	0.3 ppm	----	----
Paper fiber (Cellulose)	9004-34-6	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Paraffin wax fume	8002-74-2	2 mg/m ³	4 mg/m ³	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Paraquat	----	----	----	----	----
Respirable fraction	4685-14-7	0.1 mg/m ³	0.3 mg/m ³	----	X
	1910-42-5				
	2074-50-2				
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Pentaborane	19624-22-7	0.005 ppm	0.015 ppm	----	----
Pentachloronaphthalene	1321-64-8	0.5 mg/m ³	1.5 mg/m ³	----	X
Pentachlorophenol	87-86-5	0.5 mg/m ³	1.5 mg/m ³	----	X
Pentaerythritol	115-77-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Pentane	109-66-0	600 ppm	750 ppm	----	----
2-Pentanone (methyl propyl ketone)	107-87-9	200 ppm	250 ppm	----	----
Perchloroethylene (tetrachloroethylene)	127-18-4	25 ppm	38 ppm	----	----
Perchloromethyl mercaptan	594-42-3	0.1 ppm	0.3 ppm	----	----
Perchloryl fluoride	7616-94-6	3 ppm	6 ppm	----	----
Perlite	----	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Petroleum distillates (Naphtha, rubber solvent)	----	100 ppm	150 ppm	----	----
Phenacyl chloride (α -Chloroaceto- phenone)	532-21-4	0.05 ppm	0.15 ppm	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Phenol	108-95-2	5 ppm	10 ppm	----	X
Phenothiazine	92-84-2	5 mg/m ³	10 mg/m ³	----	X
p-Phenylenediamine	106-50-3	0.1 mg/m ³	0.3 mg/m ³	----	X
Phenyl ether (vapor)	101-84-8	1 ppm	3 ppm	----	----
Phenyl ether-diphenyl mixture (vapor)	----	1 ppm	3 ppm	----	----
Phenylethylene (Styrene)	100-42-5	50 ppm	100 ppm	----	----
Phenyl glycidyl ether (PGE)	122-60-1	1 ppm	3 ppm	----	----
Phenylhydrazine	100-63-0	5 ppm	10 ppm	----	X
Phenyl mercaptan	108-98-5	0.5 ppm	1.5 ppm	----	----
Phenylphosphine	638-21-1	----	----	0.05 ppm	----
Phorate	298-02-2	0.05 mg/m ³	0.2 mg/m ³	----	X
Phosdrin (Mevinphos)	7786-34-7	0.01 ppm	0.03 ppm	----	X
Phosgene (carbonyl chloride)	75-44-5	0.1 ppm	0.3 ppm	----	----
Phosphine	7803-51-2	0.3 ppm	1 ppm	----	----
Phosphoric acid	7664-38-2	1 mg/m ³	3 mg/m ³	----	----
Phosphorus (yellow)	7723-14-0	0.1 mg/m ³	0.3 mg/m ³	----	----
Phosphorous oxychloride	10025-87-3	0.1 ppm	0.3 ppm	----	----
Phosphorus pentachloride	10026-13-8	0.1 ppm	0.3 ppm	----	----
Phosphorus pentasulfide	1314-80-3	1 mg/m ³	3 mg/m ³	----	----
Phosphorus trichloride	12-2-19	0.2 ppm	0.5 ppm	----	----
Phthalic anhydride	85-44-9	1 ppm	3 ppm	----	----
m-Phthalodinitrile	626-17-5	5 mg/m ³	10 mg/m ³	----	----
Picloram	1918-02-1	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Picric acid (2, 4, 6-Trinitrophenol)	88-89-1	0.1 mg/m ³	0.3 mg/m ³	----	X
Pindone (2-Pivalyl-1, 3-indandione, Pival)	83-26-1	0.1 mg/m ³	0.3 mg/m ³	----	----
Piperazine dihydrochloride	142-64-3	5 mg/m ³	10 mg/m ³	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Platinum (as Pt)	7440-06-4	----	----	----	----
Metal	----	1 mg/m ³	3 mg/m ³	----	----
Soluble salts	----	0.002 mg/m ³	0.006 mg/m ³	----	----
Polychlorobiphenyls (Chlorodiphenyls)	----	----	----	----	----
42% Chlorine (PCB)	53469-21-9	1 mg/m ³	3 mg/m ³	----	X
54% Chlorine (PCB)	11097-69-1	0.5 mg/m ³	1.5 mg/m ³	----	X
Portland cement	65997-15-1	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Potassium hydroxide	1310-58-3	----	----	2 mg/m ³	----
Propane	74-98-6	1,000 ppm	1,250 ppm	----	----
Propargyl alcohol	107-19-7	1 ppm	3 ppm	----	X
beta-Propiolactone (see WAC 296-62-073)	57-57-8	----	----	----	----
Propionic acid	79-09-4	10 ppm	20 ppm	----	----
Propoxur (Baygon)	114-26-1	0.5 mg/m ³	1.5 mg/m ³	----	----
n-Propyl acetate	109-60-4	200 ppm	250 ppm	----	----
n-Propyl alcohol	71-23-8	200 ppm	250 ppm	----	X
n-Propyl nitrate	627-13-4	25 ppm	40 ppm	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Propylene	---	Simple asphyxiant	---	---	---
Propylene dichloride (1, 2-Dichloropropane)	78-87-5	75 ppm	110 ppm	---	---
Propylene glycol dinitrate	6423-43-4	0.05 ppm	0.15 ppm	---	X
Propylene glycol monomethyl ether	107-98-2	100 ppm	150 ppm	---	---
Propylene imine	75-55-8	2 ppm	4 ppm	---	X
Pyrocatachol (Catechol)	120-80-9	5 ppm	10 ppm	---	X
Quinone (p-Benzoquinone)	106-51-4	0.1 ppm	0.3 ppm	---	---
RDX (Cyclonite)	---	1.5 mg/m ³	3 mg/m ³	---	X
Resorcinol	108-46-3	10 ppm	20 ppm	---	---
Rhodium (as Rh)	7440-16-6	---	---	---	---
Insoluble compounds, metal fumes and dusts	---	0.1 mg/m ³	0.3 mg/m ³	---	---
Soluble compounds, salts	---	0.001 mg/m ³	0.003 mg/m ³	---	---
Ronnel	299-84-3	10 mg/m ³	20 mg/m ³	---	---
Rosin core solder, pyrolysis products (as formaldehyde)	8050-09-7	0.1 mg/m ³	0.3 mg/m ³	---	---
Rotenone	83-79-4	5 mg/m ³	10 mg/m ³	---	---
Rouge	---	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Rubber solvent (naphtha)	8030-30-6	100 ppm	150 ppm	---	---
Selenium compounds (as Se)	7782-49-2	0.2 mg/m ³	0.6 mg/m ³	---	---
Selenium hexafluoride (as Se)	7783-79-1	0.05 ppm	0.15 ppm	---	---
Sesone (Crag herbicide)	136-78-7	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Sevin (Carbaryl)	63-25-2	5 mg/m ³	10 mg/m ³	---	---

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Silane (see Silicon tetrahydride)	7803-62-5	5 ppm	10 ppm	----	----
Silica, amorphous, precipitated and gel	112926-00-8	6 mg/m ³	12 mg/m ³	----	----
Silica, amorphous, diatomaceous earth, containing less than 1% crystalline silica	61790-53-2	----	----	----	----
Total particulate	----	6 mg/m ³	12 mg/m ³	----	----
Respirable fraction	----	3 mg/m ³	6 mg/m ³	----	----
Silica, crystalline cristobalite	----	----	----	----	----
Respirable fraction	14464-46-1	0.05 mg/m ³	0.15 mg/m ³	----	----
Silica, crystalline quartz	----	----	----	----	----
Respirable fraction	14808-60-7	0.1 mg/m ³	0.3 mg/m ³	----	----
Silica, crystalline tripoli (as quartz)	----	----	----	----	----
Respirable fraction	1317-95-9	0.1 mg/m ³	0.3 mg/m ³	----	----
Silica, crystalline tridymite	----	----	----	----	----
Respirable fraction	15468-32-3	0.05 mg/m ³	0.15 mg/m ³	----	----
Silica, fused	----	----	----	----	----
Respirable fraction	60676-86-0	0.1 mg/m ³	0.3 mg/m ³	----	----
Silicates (less than 1% crystalline silica)	----	----	----	----	----
Mica	----	----	----	----	----
Respirable fraction	12001-26-2	3 mg/m ³	6 mg/m ³	----	----
Soapstone	----	----	----	----	----
Total particulate	----	6 mg/m ³	12 mg/m ³	----	----
Respirable fraction	----	3 mg/m ³	6 mg/m ³	----	----
Talc (containing asbestos) (see WAC 296-62-07705)	----	----	----	----	----
Talc (containing no asbestos)	----	----	----	----	----
Respirable fraction	14807-96-6	2 mg/m ³	4 mg/m ³	----	----



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Tremolite (see WAC 296-62-07705)	---	---	---	---	---
Silicon	7440-21-3	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Silicon carbide	409-21-2	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Silicon tetrahydride (Silane)	7803-62-5	5 ppm	10 ppm	---	---
Silver, metal dust and soluble compounds (as Ag)	7440-22-4	0.01 mg/m ³	0.03 mg/m ³	---	---
Soapstone	---	---	---	---	---
Total particulate	---	6 mg/m ³	12 mg/m ³	---	---
Respirable fraction	---	3 mg/m ³	6 mg/m ³	---	---
Sodium azide (as HN ₃ or NaN ₃)	26628-22-8	---	---	0.1 ppm	X
Sodium bisulfite	7631-90-5	5 mg/m ³	10 mg/m ³	---	---
Sodium-2, 4-dichloro-phenoxyethyl sulfate (Crag herbicide)	136-78-7	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Sodium fluoroacetate	62-74-8	0.05 mg/m ³	0.15 mg/m ³	---	X
Sodium hydroxide	1310-73-2	---	---	2 mg/m ³	---
Sodium metabisulfite	7681-57-4	5 mg/m ³	10 mg/m ³	---	---
Starch	9005-25-8	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Stibine	7803-52-3	0.1 ppm	0.3 ppm	---	---
Stoddard solvent	8052-41-3	100 ppm	150 ppm	---	---
Strychnine	57-24-9	0.15 mg/m ³	0.45 mg/m ³	---	---

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Styrene (Phenylethylene, Vinyl benzene)	100-42-5	50 ppm	100 ppm	----	----
Subtilisins	9014-01-1	----	0.00006 mg/m ³ (60 min.)	----	---
Sucrose	57-50-1	----	----	----	---
Total particulate	----	10 mg/m ³	20 mg/m ³	----	---
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	---
Sulfotep (TEDP)	3689-24-5	0.2 mg/m ³	0.6 mg/m ³	----	X
Sulfur dioxide	7446-09-5	2 ppm	5 ppm	----	---
Sulfur hexafluoride	2551-62-4	1,000 ppm	1,250 ppm	----	---
Sulfuric acid	7664-93-9	1 mg/m ³	3 mg/m ³	----	---
Sulfur monochloride	10025-67-9	----	----	1 ppm	---
Sulfur pentafluoride	5714-22-1	----	----	0.01 ppm	---
Sulfur tetrafluoride	7783-60-0	----	----	0.1 ppm	---
Sulfuryl fluoride	2699-79-8	5 ppm	10 ppm	----	---
Sulprofos	35400-43-2	1 mg/m ³	3 mg/m ³	----	---
Systox (Demeton)	8065-48-3	0.01 ppm	0.03 ppm	----	X
2, 4, 5-T	93-76-5	10 mg/m ³	20 mg/m ³	----	---
Talc (containing asbestos) (see WAC 296-62-07705)	----	----	----	----	---
Talc (containing no asbestos)	----	----	----	----	---
Respirable fraction	14807-96-6	2 mg/m ³	4 mg/m ³	----	---
Tantalum	----	----	----	----	---
Metal and oxide dusts	7440-25-7	5 mg/m ³	10 mg/m ³	----	---
TDI (Toluene-2, 4-diisocyanate)	584-84-9	0.005 ppm	0.02 ppm	----	---
TEDP (Sulfotep)	3689-24-5	0.2 mg/m ³	0.6 mg/m ³	----	X
Tellurium and compounds (as Te)	13494-80-9	0.1 mg/m ³	0.3 mg/m ³	----	---

1 • 8 0 0 • 4 B E S A F E (1 • 8 0 0 • 4 2 3 • 7 2 3 3)



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Tellurium hexafluoride (as Te)	7783-80-4	0.02 ppm	0.06 ppm	----	----
Temephos (Abate)	3383-96-8	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
TEPP	107-49-3	0.004 ppm	0.012 ppm	----	X
Terphenyls	26140-60-3	----	----	0.5 ppm	----
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	76-11-0	500 ppm	625 ppm	----	----
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	76-12-0	500 ppm	625 ppm	----	----
1, 1, 2, 2-Tetrachloroethane	79-34-5	1 ppm	3 ppm	----	X
Tetrachloroethylene (Perchloroethylene)	127-18-4	25 ppm	38 ppm	----	----
Tetrachloromethane (Carbon tetrachloride)	56-23-5	2 ppm	4 ppm	----	X
Tetrachloronaphthalene	1335-88-2	2 mg/m ³	4 mg/m ³	----	X
Tetraethyl lead (as Pb)	78-00-2	0.075 mg/m ³	0.225 mg/m ³	----	X
Tetrahydrofuran	109-99-9	200 ppm	250 ppm	----	----
Tetramethyl lead (as Pb)	75-74-1	0.075 mg/m ³	0.225 mg/m ³	----	X
Tetramethyl succinonitrile	3333-52-6	0.5 ppm	1.5 ppm	----	X
Tetranitromethane	509-14-8	1 ppm	3 ppm	----	----
Tetrasodium pyrophosphate	7722-88-5	5 mg/m ³	10 mg/m ³	----	----
Tetryl (2, 4, 6-trinitrophenyl-methylnitramine)	479-45-8	1.5 mg/m ³	3 mg/m ³	----	X
Thallium (soluble compounds) (as Tl)	7440-28-0	0.1 mg/m ³	0.3 mg/m ³	----	X
4, 4-Thiobis (6-tert-butyl-m-cresol)	96-69-5	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	----
Thiodan (Endosulfan)	115-29-7	0.1 mg/m ³	0.3 mg/m ³	----	X

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Thioglycolic acid	68-11-1	1 ppm	3 ppm	----	X
Thionyl chloride	7719-09-7	----	----	1 ppm	----
Thiram (see WAC 296-62-07519)	137-26-8	5 mg/m ³	10 mg/m ³	----	----
Tin (as Sn)	----	----	----	----	----
Inorganic compounds	7440-31-5	2 mg/m ³	4 mg/m ³	----	----
Tin (as Sn)	----	----	----	----	----
Organic compounds	7440-31-5	0.1 mg/m ³	0.3 mg/m ³	----	X
Tin oxide (as Sn)	21651-19-4	2 mg/m ³	4 mg/m ³	----	----
Titanium dioxide	13463-67-7	----	----	----	----
Total particulate	----	10 mg/m ³	20 mg/m ³	----	----
TNT (2, 4, 6-Trinitrotoluene)	118-96-7	0.5 mg/m ³	1.5 mg/m ³	----	X
Toluene	108-88-3	100 ppm	150 ppm	----	----
Toluene-2, 4-diisocyanate (TDI)	584-84-9	0.005 ppm	0.02 ppm	----	----
m-Toluidine	108-44-1	2 ppm	4 ppm	----	X
o-Toluidine	95-53-4	2 ppm	4 ppm	----	X
p-Toluidine	106-49-0	2.0 ppm	4 ppm	----	X
Toxaphene (Chlorinated camphene)	8001-35-2	0.5 mg/m ³	1 mg/m ³	----	X
Tremolite (see WAC 296-62-07705)	----	----	----	----	----
Tributyl phosphate	126-73-8	0.2 ppm	0.6 ppm	----	----
Trichloroacetic acid	76-03-9	1 ppm	3 ppm	----	----
1, 2, 4-Trichlorobenzene	120-82-1	----	----	5 ppm	----
1, 1, 1-Trichloroethane (Methyl chloroform)	71-55-6	350 ppm	450 ppm	----	----
1, 1, 2-Trichloroethane	79-00-5	10 ppm	20 ppm	----	----
Trichloroethylene	79-01-6	50 ppm	200 ppm	----	----
Trichlorofluoromethane (Fluorotrichloromethane)	75-69-4	----	----	1,000 ppm	----

1 • 8 0 0 • 4 B E S A F E (1 • 8 0 0 • 4 2 3 • 7 2 3 3)



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
Trichloromethane (Chloroform)	67-66-3	2 ppm	4 ppm	----	----
Trichloronaphthalene	1321-65-9	5 mg/m ³	10 mg/m ³	----	X
1, 2, 3-Trichloropropane	96-18-4	10 ppm	20 ppm	----	X
1, 1, 2-Trichloro-1, 2, 2-trifluoroethane	76-13-1	1,000 ppm	1,250 ppm	----	----
Tricyclohexyltin hydroxide (Cyhexatin)	13121-70-5	5 mg/m ³	10 mg/m ³	----	----
Triethylamine	121-44-8	10 ppm	15 ppm	----	----
Trifluorobromomethane	75-63-8	1,000 ppm	1,250 ppm	----	----
Trimellitic anhydride	552-30-7	0.005 ppm	0.015 ppm	----	----
Trimethylamine	75-50-3	10 ppm	15 ppm	----	----
Trimethyl benzene	25551-13-7	25 ppm	38 ppm	----	----
Trimethyl phosphite	121-45-9	2 ppm	4 ppm	----	----
2, 4, 6-Trinitrophenol (Picric acid)	88-89-1	0.1 mg/m ³	0.3 mg/m ³	----	X
2, 4, 6-Trinitrophenyl-methylnitramine (Tetryl)	479-45-8	1.5 mg/m ³	3 mg/m ³	----	X
2, 4, 6-Trinitrotoluene (TNT)	118-96-7	0.5 mg/m ³	1.5 mg/m ³	----	X
Triorthocresyl phosphate	78-30-8	0.1 mg/m ³	0.3 mg/m ³	----	X
Triphenyl amine	603-34-9	5 mg/m ³	10 mg/m ³	----	----
Triphenyl phosphate	115-86-6	3 mg/m ³	6 mg/m ³	----	----
Tungsten (as W)	7440-33-7	----	----	----	----
Soluble compounds	----	1 mg/m ³	3 mg/m ³	----	----
Insoluble compounds	----	5 mg/m ³	10 mg/m ³	----	----
Turpentine	8006-64-2	100 ppm	150 ppm	----	----
Uranium (as U)	7440-61-1	----	----	----	----
Soluble compounds	----	0.05 mg/m ³	0.15 mg/m ³	----	----
Insoluble compounds	----	0.2 mg/m ³	0.6 mg/m ³	----	----

Evaluate and Control
Employee Exposure



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
n-Valeraldehyde	110-62-3	50 ppm	75 ppm	---	---
Vanadium (as V ₂ O ₅)	---	---	---	---	---
Respirable fraction	1314-62-1	0.05 mg/m ³	0.15 mg/m ³	---	---
Vegetable oil mist	---	---	---	---	---
Total particulate	---	10 mg/m ³	20 mg/m ³	---	---
Respirable fraction	---	5 mg/m ³	10 mg/m ³	---	---
Vinyl acetate	108-05-1	10 ppm	20 ppm	---	---
Vinyl benzene (Styrene)	100-42-5	50 ppm	100 ppm	---	---
Vinyl bromide	593-60-2	5 ppm	10 ppm	---	---
Vinyl chloride (Chloroethylene) (see WAC 296-62-07329)	75-01-4	1 ppm	5 ppm	---	---
Vinyl cyanide (Acrylonitrile) (see WAC 296-62-07336)	107-13-1	2 ppm	10 ppm	---	---
Vinyl cyclohexene dioxide	106-87-6	10 ppm	20 ppm	---	X
Vinyl toluene	25013-15-4	50 ppm	75 ppm	---	---
Vinylidene chloride (1, 1-Dichloroethylene)	75-35-4	1 ppm	3 ppm	---	---
VM & P Naphtha	8032-32-4	300 ppm	400 ppm	---	---
Warfarin	81-81-2	0.1 mg/m ³	0.3 mg/m ³	---	---
Welding fumes (total particulate)	---	5 mg/m ³	10 mg/m ³	---	---
Wood dust	---	---	---	---	---
Nonallergenic; (All woods except allergenics)	---	5 mg/m ³	10 mg/m ³	---	---
Allergenics (e.g. cedar, mahogany and teak)	---	2.5 mg/m ³	5 mg/m ³	---	---
Xylenes (ortho, meta, and para isomers) (Dimethylbenzene)	1330-20-7	100 ppm	150 ppm	---	---



Evaluate and Control Employee Exposures

WAC 296-841-200

Rule

Table 3
Exposure Limits for Air Contaminants

Substance	CAS	TWA ₈	STEL	Ceiling	Skin
m-Xylene alpha, alpha-diamine	1477-55-0	----	----	0.1 mg/m ³	X
Xylylidine (Dimethylaminobenzene)	1300-73-8	2 ppm	4 ppm	----	X
Yttrium	7440-65-5	1 mg/m ³	3 mg/m ³	----	---
Zinc chloride fume	7646-85-7	1 mg/m ³	2 mg/m ³	----	---
Zinc chromate (as CrO ₃)	Varies with compound	0.05 mg/m ³	----	0.1 mg/m ³	---
Zinc oxide	1314-13-2	----	----	----	---
Total particulate	----	10 mg/m ³	20 mg/m ³	----	---
Respirable fraction	----	5 mg/m ³	10 mg/m	----	---
Zinc oxide fume	1314-13-2	5 mg/g ³	10 mg/m ³	----	---
Zinc stearate	557-05-1	----	----	----	---
Total particulate	----	10 mg/m ³	20 mg/m ³	----	---
Respirable fraction	----	5 mg/m ³	10 mg/m ³	----	---
Zirconium compounds (as Zr)	7440-67-2	5 mg/m ³	10 mg/m ³	----	---

Evaluate and Control
Employee Exposure



Respiratory Hazards

WAC 296-841-300

Definitions

Breathing zone

The space around and in front of an employee's nose and mouth, forming a hemisphere with a 6 to 9 inch radius.

Ceiling

An exposure limit, measured over the shortest time period feasible, that must not be exceeded during any part of the employee's workday.

Dust

Solid particles suspended in air. Dusts are generated by handling, drilling, crushing, grinding, rapid impact, detonation, or decrepitation of organic or inorganic materials such as rock, ore, metal, coal, wood, grain, etc.

Exposed or exposure

The contact an employee has with a toxic substance, harmful physical agent or oxygen deficient condition, whether or not protection is provided by respirators or other personal protective equipment (PPE). Exposure can occur through various routes of entry, such as inhalation, ingestion, skin contact, or skin absorption.

Fume

Solid particles suspended in air, generated by condensation from the gaseous state, generally after volatilization from molten metals, etc.

Gas

A normally formless fluid which can be changed to the liquid or solid state by the effect of increased pressure or decreased temperature or both.

Mist

Liquid droplets suspended in air, generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming, spraying or atomizing.

Oxygen deficient

An atmosphere with an oxygen content below 19.5% by volume.

Definitions



Respiratory Hazards

WAC 296-841-300

Definitions

WAC 296-841-300 (Continued)

Permissible exposure limits (PEL)

Permissible exposure limits (PELs) are employee exposures to toxic substances or harmful agents that must not be exceeded. PELs are specified in applicable WISHA rules.

Short-term exposure limit (STEL)

An exposure limit averaged over a short time period (usually measured for 15 minutes) that must not be exceeded during any part of an employee's workday.

Time weighted average (TWA_a)

An exposure limit averaged over 8 hours that must not be exceeded during an employee's workday.

Toxic substance

Any chemical substance or biological agent, such as bacteria, virus, and fungus, which is any of the following:

- Listed in the latest edition of the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances (RTECS)
- Shows positive evidence of an acute or chronic health hazard in testing conducted by, or known to, the employer.
- The subject of a material safety data sheet kept by or known to the employer showing the material may pose a hazard to human health.

Vapor

The gaseous form of a substance that is normally in the solid or liquid state.



Respiratory Hazards

Chapter 296-841 WAC

Resources

Helpful Tools

Mixtures of Airborne Substances R-3

Resources



Notes

1 • 800 • 4BE SAFE (1 • 800 • 423 • 7233)

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

This tool will assist you in determining if a mixture of airborne substances is a respiratory hazard. Use this tool when the concentration of each substance in the mixture is below the PEL for that substance.

- Use the following formula to determine if a respiratory hazard is present when an employee is exposed to a mixture of two or more airborne substances that are potential respiratory hazards, and the substances have additive health effects:

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \dots + \frac{C_n}{L_n}$$

The symbol	Is the
E	Equivalent exposure for the mixture. When the value of E is greater than 1 a respiratory hazard is present.
C	Concentration of a substance.
L	TWA, STEL, or ceiling for that contaminant, from Table 3.

Step 1 : Identify the health effects of the substances

- Look up the health effects in Table HT-1, which contains the health effects that were used as the basis for the PEL of each substance.
or
- Look up the health effects for the substances in the TLV booklet published by ACGIH.
or
- Use other available source, such as MSDS, RTECS, etc., to identify health effects for the substances

-Continued-



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

(Continued)

Step 2 : Compare the health effects

- If the same health effect is listed for each substance, the substances have additive health effects.
- You may use resources such as the documentation for the TLVs, OSHA preambles, and published articles to determine that the same listed health effects are not additive. Examples of when the effects would not be additive are:
 1. The toxic effects of the substances on the target organ are different.
 2. The substances affect different target organs.
 3. The mixture inhibits the toxic effect of one or more substance.
 4. The mixture increases the toxic effect of one or more substance (synergism). Synergism is a serious hazard that would be evaluated separately.

Step 3 : Look up the PELs in Table HT-1

- Use the TWA₈, STEL, or ceiling PEL value for the substances. Any PEL (TWA₈, STEL, or ceiling) will work in the formula but you must use the same time duration for all substances. For example, you cannot use an 8-hour sample and a 15-minute sample together.
- Multiple calculations may be needed to address all possible combinations, for example:

Substance A	Substance B
TWA ₈	TWA ₈
STEL	STEL
STEL	ceiling
ceiling	STEL
ceiling	ceiling

-Continued-

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

(Continued)

Step 4 : Determine the employee exposure concentrations

- Use air monitoring results for the time period covered by the PEL for each substance.

Step 5 : Plug the PEL and exposure concentration values into the formula and calculate the result

Example values:

Substance	TWA ₈ Results (PEL)	STEL Results (PEL)	Health Effects
n-Hexane	20 ppm (50)	40 ppm (75)	Irritation, CNS, Neuropathy
sec-Butyl acetate	20 ppm (200)	150 ppm (250)	Irritation
Methyl ethyl ketone	90 ppm (200)	120 ppm (300)	Irritation, CNS

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \dots + \frac{C_n}{L_n}$$

Calculation for irritation TWA₈:

$$E_m = \text{n-Hexane} + \text{sec-Butyl acetate} + \text{Methyl ethyl ketone}$$

$$E_m = 20/50 + 20/200 + 90/200$$

$$E_m = 0.4 + 0.1 + 0.45$$

$$E_m = 0.95$$

The sum is less than 1, so the mixture is **not** a respiratory hazard.

-Continued-



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

(Continued)

Calculation for irritation STEL:

$$E_m = 40/75 + 150/250 + 120/300$$

$$E_m = 0.53 + 0.75 + 0.4$$

$$E_m = 1.68$$

The sum is greater than 1, so the mixture is a respiratory hazard.

Calculation for CNS TWA₈:

$$E_m = 20/50 + 90/200$$

$$E_m = 0.4 + 0.45$$

$$E_m = 0.85$$

The sum is less than 1, so the mixture is NOT a respiratory hazard.

Calculation for CNS STEL:

$$E_m = 40/75 + 120/300$$

$$E_m = 0.53 + 0.4$$

$$E_m = 0.93$$

The sum is less than 1, so the mixture is NOT a respiratory hazard.

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1 Health Effects of Substances	
SUBSTANCE	PEL BASIS (Health Effects)
Abate (Temephos)	
Total particulate Respirable fraction	Cholinergic
Acetaldehyde	Irritation
Acetic acid	Irritation
Acetic anhydride	Irritation
Acetone	Irritation
Acetonitrile	Lung
2-Acetylaminofluorene (see WAC 296-62-073)	Cancer
Acetylene	
Acetylene dichloride (1,2-Dichloroethylene)	Liver
Acetylene tetrabromide	Irritation; liver
Acetysalicylic acid (Aspirin)	Blood
Acrolein	Irritation; pulmonary edema
Acrylamide	CNS; dermatitis
Acrylic acid	Irritation; reproductive
Acrylonitrile (see WAC 296-62-07336)	Cancer
Aldrin	Liver
Allyl alcohol	Irritation
Allyl Chloride	Liver
Allyl glycidyl ether (AGE)	Irritation; dermatitis; sensitization
Allyl propyl disulfide	Irritation
alpha-Alumina (Aluminum oxide) Total particulate Respirable fraction	Lung; irritation
Aluminum (as Al) Total particulate Respirable fraction Pyro powders Welding fumes ^d Soluble salts Alkyls (NOC)	Lung; irritation



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Aluminum oxide (Alundum, Corundum) Total particulate Respirable fraction	
4-Aminodiphenyl (see WAC 296-62-073)	Cancer (bladder)
2-Aminoethanol (Ethanolamine)	Irritation
2-Aminopyridine	CNS
Amitrole	Reproductive; thyroid
Ammonia	Irritation
Ammonium chloride, fume	Irritation
Ammonium sulfamate (Ammate) Total particulate Respirable fraction	Irritation
n-Amyl acetate	Irritation
sec-Amyl acetate	Irritation
Aniline and homologues	Anoxia
Anisidine (o, p-isomers)	Anoxia
Antimony and Compounds (as Sb)	Irritation, lung, CVS
ANTU (alpha Naphthyl thiourea)	Lung; irritation
Argon	
Arsenic, Organic compounds (as As)	Cancer (lung, skin); lung
Arsenic, Inorganic compounds (as As) (when use is covered by WAC 296-62-07347)	Cancer (lung, skin); lung
Arsenic, Inorganic compounds (as As) (when use is not covered by WAC 296-62-07347)	Cancer (lung, skin); lung
Arsine	Blood; kidney
Asbestos (see WAC 296-62-077)	Asbestosis, cancer
Asphalt (Petroleum fumes)	Irritation
Atrazine	Irritation
Azinphos methyl (Guthion)	Cholinergic
Barium, soluble compounds (as Ba)	Irritation; GI; muscles
Barium Sulfate Total particulate Respirable fraction	Pneumoconiosis (baritosis)

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Benomyl Total particulate Respirable fraction	Dermatitis; irritation; reproductive
Benzene (see WAC 296-62-07523)	Cancer
Benzidine (see WAC 296-62-073)	Cancer (bladder)
p-Benzoquinone (Quinone)	Irritation; eyes
Benzo(a) pyrene (Coal tar pitch volatiles)	Cancer
Benzoyl peroxide	Irritation
Benzyl chloride	Irritation; lung
Beryllium and beryllium compounds (as Be)	Cancer (lung); berylliosis
Biphenyl (Diphenyl)	Lung
Bismuth telluride, Undoped Total particulate Respirable fraction	Irritation Irritation, lung
Bismuth telluride, Se-doped	Irritation, lung
Borates, tetra, sodium salts Anhydrous Decahydrate Pentahydrate	Irritation Irritation Irritation
Boron oxide Total particulate	Irritation Irritation
Boron tribromide	Irritation; burns
Boron trifluoride	Irritation
Bromacil	Irritation
Bromine	Irritation
Bromine pentafluoride	Irritation
Bromochloromethane (Chlorobromomethane)	CNS; liver
Bromoform	Irritation, liver
Butadiene (1,3-butadiene)	Cancer
Butane	Narcosis
Butanethiol (Butyl mercaptan)	Irritation; CNS; reproductive



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
2-Butanone (Methyl ethyl ketone)	Irritation; CNS
2-Butoxy ethanol (Butyl Cellosolve)	Irritation
n-Butyl acetate	Irritation
sec-Butyl acetate	Irritation
tert-Butyl acetate	Irritation
Butyl acrylate	Irritation; reproductive
n-Butyl alcohol	Irritation
sec-Butyl alcohol	Irritation; narcosis
tert-Butyl alcohol	Narcosis; irritation
Butylamine	Irritation
Tert-Butyl chromate (Chromic acid)	Irritation; lung
n-Butyl glycidyl ether (BGE)	Irritation, sensitization
n-Butyl lactate	Irritation; headache
Butyl mercaptan	Irritation; CNS; reproductive
o-sec-Butylphenol	Irritation
p-tert-Butyl-toluene	Irritation; CNS; CVS
Cadmium oxide fume (as Cd) (see WAC 296-62-074)	Cancer
Cadmium dust and salts (as Cd) (see WAC 296-62-074)	Cancer; Kidney
Total particulate	
Respirable fraction	
Calcium arsenate (see WAC 296-62-07347)	Cancer
Calcium carbonate	Irritation
Total particulate	
Respirable fraction	
Calcium cyanamide	Irritation; dermatitis
Calcium hydroxide	Irritation
Calcium oxide	Irritation
Calcium silicate	Irritation
Total particulate	
Respirable fraction	

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Calcium sulfate	Irritation
Total particulate	
Respirable fraction	
Camphor (synthetic)	Irritation; anosmia
Caprolactam	Irritation
Dust	
Vapor	
Captfol (Difolatan)	Dermatitis; sensitization
Captan	Irritation
Carbaryl (Sevin)	Cholinergic; reproductive
Carbofuran (Furadon)	Cholinergic
Carbon black	Lung
Carbon dioxide	N/A
Carbon disulfide	CVS; CNS
Carbon monoxide	Anoxia; CVS; CNS; reproductive
Carbon tetrabromide	Irritation; liver
Carbon tetrachloride (Tetrachloromethane)	Liver; cancer
Carbonyl chloride (Phosgene)	Irritation; CNS; GI
Carbonyl fluoride	Irritation; bone; fluorosis
Catechol (Pyrocatechol)	Irritation; CNS; lung
Cellulose (paper fiber)	Irritation
Total particulate	
Respirable fraction	
Cesium hydroxide	Irritation
Chlordane	Seizures; liver
Chlorinated camphene (Toxaphen)	Seizures; liver
Chlorinated diphenyl oxide	Chloracne, liver
Chlorine	Irritation
Chlorine dioxide	Irritation; bronchitis
Chlorine trifluoride	Irritation; lung
Chloroacetaldehyde	Irritation



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
a-Chloroacetophenone (Phenacyl chloride)	
Chloroacetyl chloride	Irritation; lung
Chlorobenzene (Monochlorobenzene)	Liver
O-Chlorobenzylidene malononitrile (OCBM)	Irritation
Chlorobromomethane	CNS; liver
2-Chloro-1, 3-butadiene (beta-Chloroprene)	Irritation; liver; reproductive
Chlorodifluoromethane	CVS
Chlorodiphenyl (42% Chlorine) (PCB) (Polychlorobiphenyls)	Irritation; chloracne; liver
Chlorodiphenyl (54% Chlorine) (PCB) (Polychlorobiphenyls)	Irritation; chloracne; liver
1-Chloro-2, 3-epoxypropane (Epichlorhydrin)	Irritation; liver; kidney
2-Chloroethanol (Ethylene chlorohydrin)	Irritation; liver; kidney; GI; CVS; CNS
Chloroethylene (vinyl chloride)	Cancer, liver
Chloroform (Trichloromethane)	Liver; reproductive
1-Chloro-1-nitropropane	Irritation; liver; lung
bis-Chloromethyl ether (see WAC 296-62-073)	Cancer (lung)
Chloromethyl methyl ether (Methyl carbomethyl ether)	Cancer (lung); irritation
Chloropentafluoroethane	CVS
Chloropicrin (Nitrotrichloromethane)	Irritation; lung
beta-Chloroprene (2-Chloro-1, 3-butadiene)	Irritation; liver; reproductive
o-Chlorostyrene	Kidney; CNS; neurotoxic; liver
o-Chlorotoluene	Irritation
2-Chloro-6-trichloromethyl pyridine (see Nitrapyrin)	Liver
Total particulate	
Respirable fraction	
Chlorpyrifos	Cholinergic
Chromic acid and chromates (as CrO ₃)	Cancer; liver, kidney
Chromium, sol, chromic chromous salts (as Cr)	Irritation; dermatitis
Chromium (VI) compounds (as Cr)	Cancer; liver, kidney
Chromium Metal and insoluble salts	Cancer; irritation
Chromyl chloride	Kidney; liver; respiratory

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Chrysene (Coal tar pitch volatiles)	Cancer
Clopidol	Irritation
Total particulate	Irritation
Respirable fraction	Irritation
Coal dust (less than 5% SiO ₂) Respirable fraction	Pulmonary fibrosis, pneumoconiosis; pulmonary function
Coal dust (greater than or equal to 5% SiO ₂) Respirable fraction	Pulmonary fibrosis, pneumoconiosis; pulmonary function
Coal tar pitch volatiles (benzene soluble fraction anthracene, BaP, phenanthrene, acridine, chrysene, pyrene, Benzo(a) pyrene, (Particulate polycyclic aromatic hydrocarbons))	Cancer
Cobalt, metal fume & dust (as Co)	Asthma; lung; CVS
Cobalt carbonyl (as Co)	Lung edema
Cobalt hydrocarbynl (as Co)	Lung edema
Coke oven emissions (see WAC 296-62-200)	Cancer (lung)
Copper fume (as Cu)	Irritation; GI; metal fume fever
Dusts and mists (as Cu)	Irritation; GI; metal fume fever
Cotton dust (raw) see WAC 296-62-14533	Lung, byssinosis
Corundum (Aluminum oxide)	Lung; irritation
Crag herbicide (Sesone, Sodium-2, 4-dichlorophenoxyethyl sulfate)	Irritation
Total particulate	
Respirable fraction	
Cresol (all isomers)	Dermatitis, irritation, CNS
Crotonaldehyde	Irritation
Crufomate	Cholinergic
Cumene	Irritation; CNS
Cyanamide	Irritation
Cyanide (as CN)	CNS, irritation, anoxia, lung, thyroid
Cyanogen	Irritation
Cyanogen chloride	Irritation; lung function
Cyclohexane	CNS



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Cyclohexanol	Irritation; CNS
Cyclohexanone	Irritation; liver
Cyclohexene	Irritation
Cyclohexylamine	Irritation
Cyclonite (RDX)	Irritation; CNS; liver; blood
Cyclopentadiene	Irritation
Cyclopentane	Irritation; narcosis
Cyhexatin (Tricyclohexyltin hydroxide)	Irritation
2,4-D (Dichlorophenoxy- acetic acid)	Irritation
DDT (Dichlorodiphenyltri- chloroethane)	Seizures; liver
DDVP, Dichlorvos	Cholinergic
Decaborane	CNS; lung function
Demeton	Cholinergic
Diacetone alcohol (4-hydroxy-4-methyl- 2-pentanone)	Irritation
1,2-Diaminoethane (Ethylenediamine)	Irritation; asthma; sensitization
Diazinon	Cholinergic
Diazomethane	Irritation; cancer (lung)
Diborane	CNS; lung function
Dibrom (see Naled)	Cholinergic; dermatitis
1,2-Dibromo-3-chloropropane (DBCP) (see WAC 296-62-07342)	Cancer
2-N-Dibutylamino ethanol	Irritation; cholinergic
Dibutyl phosphate	Irritation
Dibutyl phthalate	Reproductive; irritation
Dichloroacetylene	GI; neurotoxicity; irritation
o-Dichlorobenzene	Irritation; liver
p-Dichlorobenzene	Irritation; kidney
3,3'-Dichlorobenzidine (see WAC 296-62-073)	Cancer; Irritation; dermatitis
Dichlorodiphenyltri- chloroethane (DDT)	Seizures; liver
Dichlorodifluoromethane	CVS
1,3-Dichloro-5,5-dimethyl hydantoin	Irritation
1,1-Dichloroethane	Liver; kidney; irritation

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
1,2-Dichlorethane (Ethylene dichloride)	Liver; narcosis
1,2-Dichloroethylene (Acetylene dichloride)	Liver
1,1-Dichloroethylene (Vinylidene chloride)	CNS; liver; kidney
Dichloroethyl ether	Irritation; lung
Dichlorofluoromethane	Liver
Dichloromethane (Methylene chloride)	CNS; anoxia
1,1-Dichloro-1-nitroethane	Irritation
1,2-Dichloropropane (Propylene dichloride)	Irritation; CNS; liver; kidney
Dichloropropene	Irritation
2,2-Dichloropropionic acid	Irritation
Dichlorotetrafluoroethane	CVS; narcosis; asphyxiation
Dichlorvos (DDVP)	Cholinergic
Dicrotophos	Cholinergic
Dicyclopentadiene	Irritation
Dicyclopentadienyl iron	Blood; liver
Total particulate	
Respirable fraction	
Dieldrin	Liver; CNS
Diethanolamine	Liver; kidney; blood
Diethylamine	Irritation
2-Diethylaminoethanol	Irritation; CNS
Diethylene triamine	Irritation; sensitization
Diethyl ether (Ethyl ether)	Irritation; narcosis
Diethyl ketone	Irritation; narcosis
Diethyl phthalate	Irritation
Difluorodibromomethane	Irritation; liver; CNS
Diglycidyl ether (DGE)	Irritation; reproductive; blood
Dihydroxybenzene (Hydroquinone)	CNS; dermatitis; ocular
Diisobutyl ketone (2, 6-Dimethylheptanone)	Irritation
Diisopropylamine	Vision; irritation
Dimethoxymethane (Methylal)	Irritation; CNS



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Dimethyl acetamide	Reproductive; liver
Dimethylamine	Irritation
4-Dimethylaminoazo benzene (see WAC 296-62-073)	Cancer
Dimethylaminobenzene (Xylidene)	Cancer; genotoxic
Dimethylaniline (N,N-Dimethylaniline)	Anoxia; neurotoxicity
Dimethylbenzene (Xylene)	Cancer; genotoxic
Dimethyl-1, 2-dibromo-2, 2-dichloroethyl phosphate (Naled)	Cholinergic; dermatitis
Dimethylformamide	Liver
2, 6-Dimethylheptanone (Diisobutyl ketone)	Irritation
1, 1-Dimethylhydrazine	Irritation; neoplasia
Dimethyl phthalate	Irritation
Dimethyl sulfate	Irritation
Dinitolmide (3, 5-Dinitro-o-toluamide)	Irritation; liver
Dinitrobenzene (all isomers) - (alpha), (meta), and (para)	Anoxia
Dinitro-o-cresol	Metabolic disorders
Dinitrotoluene	CVS; reproductive
Dioxane (Diethylene dioxide)	Irritation; liver; kidney
Dioxathion	Cholinergic
Diphenyl (Biphenyl)	Lung
Diphenylamine	Liver; kidney; blood
Diphenylmethane diisocyanate (Methylene bisphenyl isocyanate (MDI))	Irritation; lung edema; sensitization
Dipropylene glycol methyl ether	Irritation; CNS
Dipropyl ketone	Irritation; liver; kidney; neurotoxicity
Diquat	Irritation, ocular
Di-sec, Octyl phthalate (Di-2-ethylhexylphthalate)	Irritation
Disulfiram	GI; CVS
Disulfoton	Cholinergic
2, 6-Di-tert-butyl-p-cresol	Irritation

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Diuron	Irritation; blood
Divinyl benzene	Irritation
Emery	Irritation
Total particulate	Irritation
Respirable fraction	Irritation
Endosulfan (Thiodan)	Liver; CNS
Endrin	CNS; liver
Epichlorhydrin (1-Chloro-2, 3-epoxypropane)	Irritation; liver; kidney
EPN	Cholinergic
1, 2-Epoxypropane (Propylene oxide)	Irritation; cancer (nasal)
2, 3-Epoxy-1-propanol (Glycidol)	Irritation; neoplasia
Ethane	
Ethanethiol (Ethyl mercaptan)	Irritation
Ethanolamine (2-Aminoethanol)	Irritation
Ethion	Cholinergic
2-Ethoxyethanol (Glycol monoethyl ether)	Reproductive
2-Ethoxyethyl acetate (Cellosolve acetate)	Reproductive
Ethyl acetate	Irritation
Ethyl acrylate	Irritation; cancer; sensitization
Ethyl alcohol (ethanol)	Irritation
Ethylamine	Irritation
Ethyl amyl ketone (5-Methyl-3-heptanone)	Irritation
Ethyl benzene	Irritation; CNS
Ethyl bromide	Liver; kidney; CVS
Ethyl butyl ketone (3-Heptanone)	Irritation; narcosis
Ethyl chloride	Liver; CNS
Ethylene	N/A
Ethylene chlorohydrin (2-Chloroethanol)	Irritation; liver; kidney; GI; CVS; CNS
Ethylenediamine (1,2-Diaminoethane)	Irritation; asthma; sensitization
Ethylene dibromide	Irritation; liver; kidney
Ethylene dichloride (1,2-Dichloroethane)	Liver; narcosis
Ethylene glycol	Irritation



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Ethylene glycol dinitrate	CVS
Ethylene glycol monomethyl ether acetate (Methyl cellosolve acetate)	Blood, reproductive, CNS
Ethyleneimine (see WAC 296-62-073)	Irritation; bronchitis
Ethylene oxide (see WAC 296-62-07359)	Cancer; reproductive
Ethyl ether (Diethyl ether)	Irritation; narcosis
Ethyl formate	Irritation
Ethyldine chloride (1, 1-Dichloroethane)	Liver; narcosis
Ethyldene norbornene	Irritation
Ethyl mercaptan (Ethanethiol)	Irritation
n-Ethylmorpholine	Irritation; ocular
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	Irritation
Ethyl silicate	Irritation; kidney
Fenamiphos	Cholinergic
Fensulfothion (Dasanit)	Cholinergic
Fenthion	Cholinergic
Ferbam	
Total particulate	Irritation
Ferrovanadium dust	Irritation
Fluorides (as F)	Irritation, bone, fluorosis
Fluorine	Irritation
Fluorotrichloromethane (see Trichlorofluoro methane)	CVS; CNS
Fonofos	Cholinergic
Formaldehyde (see WAC 296-62-07540)	Irritation; cancer (nasal)
Formamide	Irritation; liver
Formic acid	Irritation
Furfural	Irritation
Furfuryl alcohol	Irritation
Gasoline	Irritation; CNS
Germanium tetrahydride	Blood
Glass, fibrous or dust	Irritation
Glutaraldehyde	Irritation; sensitization

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Glycerin mist	Irritation
Total particulate	
Respirable fraction	
Glycidol (2, 3-Epoxy-1- propanol)	Irritation; neoplasia
Glycol monoethyl ether (2-Ethoxyethanol)	Reproductive
Grain dust (oat, wheat, barley)	Irritation; bronchitis; pulmonary function
Graphite, natural Respirable dust	Pneumoconiosis
Graphite, Synthetic	Pneumoconiosis
Total particulate	
Respirable fraction	
Guthion (Azinphosmethyl)	Cholinergic
Gypsum	Irritation
Total particulate	
Respirable fraction	
Hafnium	Liver; irritation
Helium	
Heptachlor	CNS, liver, blood
Heptane (n-heptane)	Irritation; narcosis
2-Heptanone (Methyl n-amyl ketone)	Irritation
3-Heptanone (Ethyl butyl ketone)	Irritation; narcosis
Hexachlorobutadiene	Irritation; kidney
Hexachlorocyclopentadiene	Irritation; pulmonary edema
Hexachloroethane	Irritation; liver; kidney
Hexachloronaphthalene	Liver; chloracne
Hexafluoroacetone	Reproductive; kidney
Hexane	CNS, irritation
n-hexane	Neuropathy; CNS; irritation
other Isomers	Neuropathy; CNS; irritation
2-Hexanone (Methyl-n-butyl ketone)	Neuropathy
Hexone (Methyl isobutyl ketone)	Irritation; kidney
sec-Hexyl acetate	Irritation





Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Hexylene Glycol	Irritation
Hydrazine	Irritation; liver
Hydrogen	N/A
Hydrogenated terphenyls	Irritation, liver
Hydrogen bromide	Irritation
Hydrogen chloride	Irritation; corrosion
Hydrogen cyanide	CNS, irritation, anoxia, lung, thyroid
Hydrogen fluoride	Irritation; bone; teeth; fluorosis
Hydrogen peroxide	Irritation; pulmonary edema; CNS
Hydrogen selenide (as Se)	Irritation; GI
Hydrogen Sulfide	Irritation; CNS
Hydroquinone (Dihydroxybenzene)	CNS; dermatitis; ocular
4-Hydroxy-4-methyl-2- pentanone (Diacetone alcohol)	Irritation
2-Hydroxypropyl acrylate	irritation
Indene	Irritation; liver; kidney
Indium and compounds (as In)	Pulmonary edema; bone; GI
Iodine	Irritation
Iodoform	CNS; liver; kidney; CVS
Iron oxide dust and fume (as Fe)	Pneumoconiosis (siderosis)
Total particulate	
Iron pentacarbonyl (as Fe)	Pulmonary edema; CNS
Iron salts, soluble (as Fe)	Irritation
Isoamyl acetate	Irritation
Isoamyl alcohol (primary and secondary)	Irritation
Isobutyl acetate	Irritation
Isobutyl alcohol	Irritation, ocular
Isooctyl alcohol	Irritation
Isophorone	Irritation; narcosis
Isophorone diisocyanate	Dermatitis; asthma; sensitization
Isopropoxyethanol	Blood

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Isopropyl acetate	Irritation
Isopropyl alcohol	Irritation
Isopropylamine	Irritation
N-Isopropylaniline	Blood
Isopropyl ether	Irritation
Isopropyl glycidyl ether (IGE)	Irritation; dermatitis
Kaolin	
Total particulate	
Respirable fraction	Pneumoconiosis
Ketene	Lung irritation; lung edema
Lead inorganic (as Pb) (see WAC 296-62-07521)	CNS; blood; kidney; reproductive
Lead arsenate (see WAC 296-62-07347)	CNS; anemia; kidney; reproductive
Lead chromate	Cancer; CVS; reproductive
Limestone	
Total particulate	
Respirable fraction	Irritation
Lindane	CNS; liver
Lithium hydride	Irritation
L.P.G. (liquified petroleum gas)	N/A
Magnesite	
Total particulate	
Respirable fraction	Irritation; pneumoconiosis
Magnesium oxide fume	Irritation; metal fume fever
Total particulate	
Malathion	
Total particulate	Cholinergic; CNS; neuropathy; vision
Maleic anhydride	Irritation; asthma
Manganese and compound (as Mn)	CNS (manganism); lung; reproductive
Manganese tetroxide and fume (as Mn)	CNS (manganism); lung; reproductive
Manganese cyclopentadienyl tricarbonyl (as Mn)	CNS; pulmonary edema
Manganese tetroxide (as Mn)	CNS (manganism); lung; reproductive
Marble	
Total particulate	
Respirable fraction	Irritation



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Mercury (aryl and inorganic) (as Hg)	CNS; neuropathy; vision; kidney; reproductive; GI
Mercury (organo-alkyl compounds) (as Hg)	CNS
Mercury (vapor) (as Hg)	CNS
Mesityl oxide	Irritation; narcosis; liver; kidney
Methacrylic acid	Irritation
Methane	N/A
Methanethiol (Methyl mercaptan)	Irritation; CNS
Methomyl (Iannate)	Cholinergic
Methoxychlor	CNS; liver
Total particulate	CNS; liver
2-Methoxyethanol (Methyl cellosolve)	Blood; reproductive; CNS
4-Methoxyphenol	Eye; depigmentation
Methyl acetate	Irritation; narcosis
Methyl acetylene (propane)	Anesthesia
Methyl acetylene-propadiene mixture (MAPP)	Anesthesia
Methyl acrylate	Irritation
Methylacrylonitrile	Irritation; CNS
Methylal (Dimethoxy-methane)	Irritation; CNS
Methyl alcohol (methanol)	Neuropathy; vision; CNS
Methylamine	Irritation
Methyl amyl alcohol (Methyl isobutyl carbinol)	Irritation; anesthesia
Methyl n-amyl ketone (2-Heptanone)	Irritation
N-Methyl aniline (see Monomethyl aniline)	Anoxia; blood
Methyl bromide	Irritation
Methyl butyl ketone (see 2-Hexanone)	Neuropathy
Methyl cellosolve (see 2-Methoxyethanol)	Blood; reproductive; CNS
Methyl cellosolve acetate (2-Methoxyethyl acetate)	Blood; reproductive; CNS
Methyl chloride	Kidney; CNS; reproductive
Methyl chloroform (1,1,1-trichlorethane)	Anesthesia; CNS
Methyl chloromethyl ether (see WAC 296-62-073)	Cancer (lung); irritation
Methyl 2-cyanoacrylate	Irritation; dermatitis

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Methylcyclohexane	Narcosis; irritation
Methylcyclohexanol	Irritation; narcosis; liver; kidney
Methylcyclohexanone	Irritation; narcosis
Methylcyclopentadienyl manganese tricarbonyl (as Mn)	CNS, liver, kidney
Methyl demeton	Irritation; cholinergic
Methylene bisphenyl isocyanate (MDI) (Diphenylmethane diisocyanate)	Irritation; lung edema; sensitization
4, 4'-Methylene bis (2-chloro- aniline) (MBOCA) (see WAC 296-62-073)	Cancer
Methylene bis (4-cyclohexylisocyanate)	Irritation; sensitization
Methylene chloride (see WAC 296-62-07470) Dichloromethane	CNS; anoxia
4, 4-Methylene dianiline	Liver
Methyl ethyl ketone (MEK) (2-Butanone)	Irritation; CNS
Methyl ethyl ketone peroxide (MEKP)	Irritation; liver; kidney
Methyl formate	Irritation; narcosis.; lung edema
5-Methyl-3-heptanone (Ethyl amyl ketone)	Irritation
Methyl hydrazine (Monomethyl hydrazine)	Irritation; liver
Methyl iodide	CNS; irritation
Methyl isoamyl ketone	Irritation; narcosis; liver; kidney
Methyl isobutyl carbinol (Methyl amyl alcohol)	Irritation; anesthesia
Methyl isobutyl ketone (Hexone)	Irritation; kidney
Methyl isocyanate	Irritation; lung edema; sensitization
Methyl isopropyl ketone	Irritation
Methyl mercaptan (Methanethiol)	Irritation; CNS
Methyl methacrylate	Irritation; dermatitis
Methyl parathion	Cholinergic
Methyl propyl ketone (2-Pantanone)	Irritation; narcosis
Methyl silicate	Ocular (severe), lung
alpha-Methyl styrene	Irritation; dermatitis; CNS
Mevinphos (Phosdrin)	Cholinergic
Metribuzin	Blood; liver



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Mica (Silicates)	Pneumoconiosis
Molybdenum (as Mo)	
Soluble compounds	Irritation, metabolic disorder
Insoluble compounds (Total particulate)	Irritation
Monocrotophos (Azodrin)	Cholinergic
Monomethyl aniline (N-Methyl aniline)	Anoxia; blood
Monomethyl hydrazine	Irritation, liver
Morpholine	Irritation; vision
Naled (Dibrom)	Cholinergic; dermatitis
Naphtha (Coal tar)	Irritation; CNS
Naphthalene	Irritation; ocular; blood
alpha-Naphthylamine (see WAC 296-62-073)	Cancer
beta-Naphthylamine (see WAC 296-62-073)	Cancer (bladder)
Neon	N/A
Nickel carbonyl (as Ni)	Irritation; CNS
Nickel (as Ni)	Dermatitis; pneumoconiosis
Metal and insoluble compounds	Cancer (lung), irritation, dermatitis
Soluble compounds	CNS, irritation, dermatitis
Nicotine	CVS; GI; CNS
Nitrapyrin (2-Chloro-6 trichloromethyl pyridine)	Liver
Total particulate	
Respirable fraction	
Nitric acid	Irritation; corrosion; pulmonary edema
Nitric oxide	Anoxia; irritation; cyanosis
p-Nitroaniline	Anoxia; anemia; liver
Nitrobenzene	Anoxia
4-Nitrobiphenyl (see WAC 296-62-073)	Cancer (bladder)
p-Nitrochlorobenzene	Anoxia; blood; liver
4-Nitrodiphenyl (see WAC 296-62-073)	Cancer
Nitroethane	Irritation; narcosis; liver
Nitrogen	N/A

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Nitrogen dioxide	Irritation; pulmonary edema
Nitrogen trifluoride	Anoxia; blood; liver; kidney
Nitroglycerin	CVS
Nitromethane	Thyroid
1-Nitropropane	Irritation; liver
2-Nitropropane	Liver; cancer
N-Nitrosodimethylamine (see WAC 296-62-073)	Cancer;; liver
Nitrotoluene	Anoxia; cyanosis
o-isomer	
m-isomer	
p-isomer	
Nitrotrichloromethane (Chloropicrin)	Irritation; lung
Nitrous Oxide (Nitrogen oxide)	Reproductive; blood; CNS
Nonane	CNS; skin; irritation
Octachloronaphthalene	Liver; dermatitis
Octane	Irritation
Oil mist mineral (particulate)	Lung
Osmium tetroxide (as Os)	Irritation; vision
Oxalic acid	Irritation; burns
Oxygen difluoride	Irritation; kidney
Ozone	Lung function; irritation
Paraffin wax fume	Irritation
Paraquat (Respirable fraction)	Pulmonary edema, kidney, liver, pulmonary fibrosis
Parathion	Cholinergic
Particulate polycyclic aromatic hydrocarbons (coal tar pitch volatiles)	Cancer
Particulates not otherwise regulated	Lung
Total particulate	
Respirable fraction	
Pentaborane	CNS
Pentachloronaphthalene	Chloracne; liver
Pentachlorophenol	CVS; CNS



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Pentaerythritol	Irritation
Total particulate	
Respirable fraction	
Pentane	Irritation; narcosis
2-Pentanone (methyl propyl ketone)	Irritation; narcosis
Perchloroethylene (tetrachloroethylene)	Irritation; CNS
Perchloromethyl mercaptan	Irritation; pulmonary edema
Perchloryl fluoride	Irritation; blood
Perlite	Irritation
Total particulate	
Respirable fraction	
Petroleum distillates (Naphtha, Rubber Solvent)	Irritation; CNS
Phenol	Irritation; CNS; blood
Phenothiazine	Irritation; ocular; liver; kidney
p-Phenylenediamine	Sensitization; skin; eye
Phenyl ether (vapor)	Irritation; nausea
Phenyl ether-diphenyl mixture (vapor)	Irritation; nausea
Phenylethylene (Styrene)	Neurotoxicity; irritation; CNS
Phenyl glycidyl ether (PGE)	Irritation; dermatitis; sensitization
Phenylhydrazine	Dermatitis; anemia
Phenyl mercaptan	Irritation; dermatitis
Phenylphosphine	Irritation; dermatitis; blood; reproductive
Phorate	Cholinergic
Phosdrin (Mevinphos)	Cholinergic
Phosgene (carbonyl chloride)	Irritation; anoxia; lung edema
Phosphine	Irritation; CNS; GI
Phosphoric acid	Irritation
Phosphorus (yellow)	Irritation; liver; kidney; CVS; GI
Phosphorous oxychloride	Irritation; kidney
Phosphorus pentachloride	Irritation
Phosphorus pentasulfide	Irritation

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Phosphorus trichloride	Irritation
Phthalic anhydride	Irritation; sensitization
m-Phthalodinitrile	Irritation
Picloram	Liver; kidney
Total particulate	
Respirable fraction	
Picric acid (2, 4, 6-Trinitrophenol)	Dermatitis; irritation; ocular; sensitization
Pindone (2-Pivalyl-1, 3-indandione, Pival	Liver; kidney; bleeding; dermatitis
Piperazine dihydrochloride	Irritation; burns; asthma; sensitization
Pival (Pindone)	Liver; kidney; bleeding; dermatitis
Plaster of Paris	Irritation
Total particulate	
Respirable fraction	
Platinum (as Pt)	
Metal	Irritation
Soluble salts	Asthma, irritation, sensitization
Polychlorobiphenyls (Chlorodiphenyls)	Irritation; chloracne; liver
Portland cement	Irritation; Dermatitis
Total particulate	
Respirable fraction	
Potassium hydroxide	Irritation; corrosion
Propane	N/A
Propargyl alcohol	Irritation; liver; kidney
beta-Propiolactone (see WAC 296-62-073)	Irritation
Propionic acid	Irritation
Propoxur (Baygon)	Cholinergic
n-Propyl acetate	Irritation
n-Propyl alcohol	Irritation; narcosis
n-Propyl nitrate	Blood; cyanosis; anoxia
Propylene	
Propylene dichloride (1,2-Dichloropropane)	Irritation; CNS; liver; kidney



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Propylene glycol dinitrate	CVS; headache; CNS, anoxia
Propylene glycol monomethyl ether	Irritation; anesthesia
Propylene imine	Irritation; CNS
Propylene oxide (1, 2-Epoxypropane)	Irritation; cancer (nasal)
Propyne (Methyl acetylene)	Anesthesia
Pyrethrum	Dermatitis; CNS; liver; sensitization
Pyridine	Irritation; CNS; liver; kidney; blood
Quinone (p-Benzoquinone)	Irritation; eyes
RDX (Cyclonite)	Irritation; CNS; liver; blood
Resorcinol	Irritation; dermatitis; blood
Rhodium (as Rh) Insoluble compounds,	Irritation
Metal fumes and dusts	
Soluble compounds, salts	
Ronnel	Cholinergic
Rosin core solder, pyrolysis products (as formaldehyde)	Cholinergic
Rotenone	Irritation; CNS
Rouge	Lung, siderosis, irritation
Total particulate	
Respirable fraction	
Rubber solvent (naphtha)	Irritation, CNS
Selenium compounds (as Se)	Irritation
Selenium hexafluoride (as Se)	Pulmonary edema
Sesone (Crag herbicide)	Irritation
Silane (see Silicon tetrahydride)	Irritation
Silica, amorphous, precipitated and gel	Irritation
Silica, amorphous, diatomaceous earth, containing less than 1% crystalline silica	Irritation; pneumoconiosis
Total particulate	
Respirable fraction	
Silica, crystalline cristobalite, respirable fraction	Lung fibrosis; silicosis
Silica, crystalline quartz, respirable fraction	Silicosis; lung function; lung fibrosis; cancer

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Silica, crystalline tripoli (as quartz), respirable fraction	Lung fibrosis
Silica, crystalline tridymite, respirable fraction	Lung fibrosis; silicosis
Silica, fused, respirable fraction	Lung fibrosis
Silicates (less than 1% crystalline silica)	
Mica (Respirable fraction)	Pneumoconiosis
Soapstone, Total particulate	Pneumoconiosis
Soapstone, Respirable fraction	Pneumoconiosis
Talc (containing asbestos) use asbestos limit (see WAC 296-62-07705)	Lung, asbestosis
Talc (containing no asbestos) Respirable fraction	Lung
Tremolite (see WAC 296-62-07705)	Lung, asbestosis
Silicon	Lung
Total particulate	
Respirable fraction	
Silicon Carbide	Lung
Total particulate	
Respirable fraction	
Silicon tetrahydride (Silane)	Irritation
Silver, metal dust and soluble compounds (as Ag)	Argyria (skin, eyes, mucosa)
Soapstone,	Pneumoconiosis
Total particulate	
Respirable fraction	
Sodium azide	CNS; CVS; lung
(as HN3)	Irritation
(as NaN3)	Irritation
Sodium bisulfite	Irritation
Sodium-2, 4-dichloro- phenoxyethyl sulfate (Crag herbicide)	Irritation
Sodium fluoroacetate	CNS; CVS
Sodium hydroxide	Irritation



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Sodium metabisulfite	Irritation
Starch	Dermatitis; lung
Total particulate	
Respirable fraction	
Stibine	Irritation; blood
Stoddard solvent	Irritation; narcosis; kidney
Strychnine	CNS
Styrene (Phenylethylene, Vinyl benzene)	Neurotoxicity; irritation; CNS
Subtilisins	Irritation, lung, sensitization
Sucrose	Lung
Total particulate	
Respirable fraction	
Sulfotep (TEDP)	Cholinergic
Sulfur dioxide	Irritation
Sulfur hexafluoride	N/A
Sulfuric acid	Irritation; cancer (larynx)
Sulfur monochloride	Irritation
Sulfur pentafluoride	Irritation
Sulfur tetrafluoride	Irritation
Sulfuryl fluoride	Irritation; CNS
Sulprofos	Cholinergic
Systox (Demeton)	Cholinergic
2, 4, 5-T	Irritation
Talc (Silicates)	Lung
Tantalum Metal and oxide dusts	Irritation; lung
TEDP (Sulfotep)	Cholinergic
Tellurium and compounds (as Te)	CNS; cyanosis; liver
Tellurium hexafluoride (as Te)	Irritation
Temephos (Abate)	Cholinergic
Total particulate	
Respirable fraction	

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards



Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
TEPP	Cholinergic
Terphenyls	Irritation
1, 1, 1, 2-Tetrachloro- 2, 2-difluoroethane	Liver, blood
1, 1, 2, 2-Tetrachloro- 1, 2-difluoroethane	CNS; pulmonary edema
1, 1, 2, 2-Tetrachloroethane	Liver; CNS; GI
Tetrachloroethylene (Perchloroethylene)	Irritation; CNS
Tetrachloromethane (Carbon tetrachloride)	Liver; cancer
Tetrachloronaphthalene	Liver
Tetraethyl lead (as Pb)	CNS
Tetrahydrofuran	Irritation; narcosis
Tetramethyl lead (as Pb)	CNS
Tetramethyl succinonitrile	CNS
Tetranitromethane	Irritation
Tetrasodium pyrophosphate	Irritation
Tetryl (2, 4, 6-trinitrophenyl- methylnitramine)	Liver; dermatitis; sensitization
Thallium (soluble compounds) (as Tl)	Irritation; CNS; CVS
4, 4-Thiobis (6-tert-butyl-m-cresol)	Liver; kidney
Total particulate	Liver; kidney
Respirable fraction	Liver; kidney
Thioglycolic acid	Irritation
Thionyl chloride	Irritation
Thiram (see WAC 296-62-07519)	Cancer; irritation
Tin (as Sn) Inorganic compounds (except oxides)	Stanosis
Tin, Organic compounds (as Sn)	CNS, immunotoxicity, irritation
Tin Oxide (as Sn)	Stanosis
Titanium dioxide	Lung
Total particulate	
Toluene	CNS
Toluene-2, 4-diisocyanate (TDI)	Irritation; sensitization
m-Toluidine	Anoxia; kidney
o-Toluidine	Anoxia; kidney



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
p-Toluidine	Anoxia; kidney
Toxaphene (Chlorinated camphene)	Seizures; liver
Tremolite (see WAC 296-62-07705)	Lung, asbestosis
Tributyl phosphate	Irritation; cholinergic
Trichloroacetic acid	Irritation
1, 2, 4-Trichlorobenzene	Irritation
1, 1, 1-Trichloroethane (Methyl chloroform)	Anesthesia; CNS
1, 1, 2-Trichloroethane	CNS; liver
Trichloroethylene	CNS; headache; liver
Trichlorofluoromethane	CVS; CNS
Trichloromethane (Chloroform)	Liver; reproductive
Trichloronaphthalene	Liver
1, 2, 3-Trichloropropane	Liver; kidney
1, 1, 2-Trichloro- 1, 2, 2-trifluoroethane	Narcosis; CVS; asphyxiation
Tricyclohexyltin hydroxide (Cyhexatin)	Irritation
Triethylamine	Irritation; vision
Trifluorobromomethane	CNS; CVS
Trimellitic anhydride	Bleeding (lung); immunotoxicity; sensitization
Trimethylamine	Irritation
Trimethyl benzene	Irritation; CNS; blood
Trimethyl phosphite	Irritation
2, 4, 6-Trinitrophenol (Picric acid)	Dermatitis; irritation; ocular; sensitization
2, 4, 6-Trinitrophenyl- methylnitramine (Tetryl)	Liver; dermatitis; sensitization
2, 4, 6-Trinitrotoluene (TNT)	Irritation; liver; blood; eye
Triorthocresyl phosphate	CNS; cholinergic
Triphenyl amine	Irritation
Triphenyl phosphate	Irritation; dermatitis
Tungsten (as W)	
Soluble compounds	CNS, irritation
Insoluble compounds	Irritation
Turpentine	Irritation

Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Uranium (as U)	Kidney; blood; cancer
Soluble compounds	
Insoluble compounds	
n-Valeraldehyde	Irritation
Vanadium (as V2O5) Respirable fraction	Irritation; lung
Vegetable oil mist	Lung
Total particulate	
Respirable fraction	
Vinyl acetate	Irritation
Vinyl benzene (Styrene)	Neurotoxicity; irritation; CNS
Vinyl bromide	Liver; CNS; cancer
Vinyl chloride (see WAC 296-62-07329) (Chloroethylene)	Cancer (liver)
Vinyl cyanide (See WAC WAC 296-62-07336,Acrylonitrile)	Cancer
Vinyl cyclohexene dioxide	Irritation; dermatitis; reproductive
Vinyl toluene	Irritation
Vinyldene chloride (1, 1-Dichloroethylene)	CNS; liver; kidney
VM & P Naphtha	Irritation; CNS
Warfarin	Blood; bleeding
Welding fumes ^a (total particulate)	Metal fume fever, irritation
Wood dust	
Nonallergenic (All woods except allergenics)	Irritation, dermatitis, lung
Allergenics (e.g. cedar, mahogany and teak)	Cancer, irritation, mucostasis
Xylenes (Xylool) (o-, m-, p-isomers) (Dimethylbenzene)	Irritation
m-Xylene alpha, alpha-diamine	Irritation; blood
Xylidine (Dimethylaminobenzene)	Cancer; genotoxic
Yttrium	Fibrosis
Zinc chloride fume	Irritation; lung edema
Zinc chromate (as Cr03)	Cancer (lung)
Zinc oxide	Lung
Total particulate	
Respirable fraction	



Mixtures of Airborne Substances

Use with Chapter 296-841 WAC, Respiratory Hazards

Table HT-1
Health Effects of Substances (Continued)

SUBSTANCE	PEL BASIS (Health Effects)
Zinc oxide fume	Lung, metal fume fever
Zinc stearate	Lung
Total particulate	
Respirable fraction	
Zirconium compounds (as Zr)	Lung

Respiratory Hazards

Chapter 296-841 WAC

Index

A

- Action level, **200-2-3**
Air Contaminants, exposure limits table 3, **200-10-49**
Airborne substances
examples, **100-2**
mixtures, helpful tool, **R 7-34**

C

- CAS numbers, table 3, **200-10-49**
Ceiling limit, table 3, **200-10-49**, **300-1**
Chapter application, scope, **100-1-3**
Controlling hazards, **200-4-6**
Controls
examples, table 1, **200-5**
feasible, types, table 1, **200-5**
Corrective action, table 2, **200-7**

D

- Definitions, **300-1-2**

E

- Emergency situations, **200-2**
Employee
notification, table 2, **200-6-7**
control methods, **200-4-6**
Exposure
controls, feasible, **200-6**
definition, **300-1**
limits for air contaminants, table 3, **200-10-49**
protection from hazards, **200-6**
personal air sampling, **200-8**
routes of entry, **100-1**
Exposure estimates, **200-2**

F

- Feasible controls, **100-1**, **200-4**

H

- Hazards, identifying, evaluating, **200-2-3**

I

- Immediately dangerous to life or health (IDLH)
atmospheres, **200-3**

N

- NIOSH registry of toxic effects of chemical
substances, **100-2**
respiratory hazards, **100-2**
Notification requirements, table 2, **200-7**

O

- Over exposure, PEL, **200-2-3**
Oxygen deficient atmosphere, **100-1**, **300-1**

P

- Particulate, respirable fraction, **200-9**
Permissible exposure limits (PELs)
definition, **300-2**
exposure, table 2, **200-7**
mixtures, **200-4**
Personal air sampling, **200-3**
Personal protective equipment (PPE), **200-4**

R

- Rescue situations, **200-2**
Respirators, use, **100-1**, **200-6**
Respiratory protection
exposed employee, notification, table 2, **200-7**
identifying, controlling, evaluating, **200-2-3**

S

- Sampling method, validation, **200-3**
Scope, chapter application, **100-1-3**
Short term exposure limit (STEL), **300-2**
Skin absorption, **200-8**, 10-49

Index



Respiratory Hazards

Chapter 296-841 WAC

Index

T

Time weighted average (TWA), **200-8**, 10-49,
300-2

V

Ventilation, table 1, **200-5**
(see also controls)

W

Work practices, **200-2**

Index



Respiratory Hazards

Chapter 296-841 WAC

Statutory Authority

296-841-100 Scope.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-18-079 (Order 04-25), § 296-841-100, filed 08/31/04, effective 11/01/04. Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-20-115 (Order 03-09), § 296-841-100, filed 10/01/03, effective 01/01/04.]

296-841-200 Evaluate and control employee exposures.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-20-115 (Order 03-09), § 296-841-200, filed 10/01/03, effective 01/01/04.]

296-841-20005 Identify and evaluate respiratory hazards.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-18-079 (Order 04-25), § 296-841-20005, filed 08/31/04, effective 11/01/04. Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-20-115 (Order 03-09), § 296-841-20005, filed 10/01/03, effective 01/01/04.]

296-841-20010 Control employee exposures.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-18-079 (Order 04-25), § 296-841-20010, filed 08/31/04, effective 11/01/04. Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-20-115 (Order 03-09), § 296-841-20010, filed 10/01/03, effective 01/01/04.]

296-841-20015 Use respirators.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-20-115 (Order 03-09), § 296-841-20015, filed 10/01/03, effective 01/01/04.]

296-841-20020 Notify employees.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-18-079 (Order 04-25), § 296-841-20020, filed 08/31/04, effective 11/01/04. Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-20-115 (Order 03-09), § 296-841-20020, filed 10/01/03, effective 01/01/04.]

296-841-20025 Permissible exposure limits of air contaminants.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-18-079 (Order 04-25), § 296-841-20025, filed 08/31/04, effective 11/01/04.]

296-841-300 Definitions.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-18-079 (Order 04-25), § 296-841-300, filed 08/31/04, effective 11/01/04. Statutory Authority: RCW 49.17.010, .040, .050, and .060. 03-20-115 (Order 03-09), § 296-841-300, filed 10/01/03, effective 01/01/04.]

Respiratory Hazards

Chapter 296-841 WAC

Statutory Authority